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THESIS

S4705

MESSAGE NETWORK SIMULATION

by

KUO-TUNG SHIH

March 1990

Thesis Advisor LCDR Roger Stemp

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MESSAGE NETWORK SIMULATION

by

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Submitted in partial fulfillment of the
requirements for the degree of

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ABSTRACT

This thesis presents a computer simulation of a multinode data communication network using a virtual network model to determine the effects of various system parameters on overall network performance.

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I. INTRODUCTION

This thesis attempts, through computer simulation, to develop a simplified model of a packet switching data communication network, in order to be able to determine the effects of various system parameters on network performance. The network being modelled consists of a single transmitter and receiver with numerous switching stations. The simplifying assumption is that all the packet switching stations can be reduced to a single virtual network by using an exponentially distributed network transit function. The body of the thesis provides a simple description of *real-world* packet switching operations, a general overview of the simulation model and, finally, the results and conclusions obtained from the simulation.

II. FUNDAMENTALS OF PACKET SWITCHING

A. PACKET SWITCHING NETWORKS

Packet switching is a direct result of the requirement for secure military voice communications. During two way voice communications, the transmissions are divided into discrete units called packets. This achieves a simple form of communications security because anyone attempting to monitor packet switched communications hears only meaningless chatter. The packets must be reassembled in the correct order at the destination for the transmission to make sense. [Ref. 1: p. 31]

Most of today's packet switching applications are concerned with the transmission of computer database information. The wide distribution of computer resources (mainframe computers, minicomputers, microcomputers and home computers) joined together in vast networks leads to an increased need for efficient and cost effective communications among them.

Packet switching is especially well suited for the needs of computer and data communications users. Because of the processing capabilities of the switching facilities in the network, packet switching networks retain most of the features and advantages of simpler message switching systems. That is, the network provides format, code and speed conversions between different terminal devices, it appears nonblocking, and achieves both a very high network efficiency and high utilization of communication lines. Through the use of logical multiplexing on a single line, a single high-speed access line into the network can be used, thus allowing large computers to converse with many lower speed devices at the same time. [Ref. 1: p. 37]

Some messages are short enough to fit into a single packet or less, but this is not usually the case. Generally, messages are broken into several packets of uniform size; as a result, the interference problem due to different message sizes is minimized. Additionally, packet switching yields consistent delay patterns in the network and a rapid exchange of short messages (except under extreme overload circumstances). The switches are designed to operate in near real time and system capacity is limited only by the number of switches and communication lines. Since packet switching operates in near real time and since individual packets do not have to follow the same route to the destination, the network is very flexible and adaptable. [Ref. 1: p. 37]

The primary disadvantage is that packet switching networks are more complex; they, therefore, require more complex routing schemes, control procedures, switches and processors to reassemble messages at the destination station. [Ref. 1: p. 38]

B. PACKET SWITCHING OPERATIONS

1. Basic Network Operation

Figure 1 on page 4 illustrates basic network operations. There may be numerous users simultaneously attached to the network. Suppose user X is attached at switch A and user Y is attached at switch D. User X wants to transmit one message to user Y. The message to be transmitted is four packets long and must be in the correct order for the message to make sense. At the same time, there are many other packets that are moving, which may have been transmitted from different switching stations, throughout the network. After the message is transmitted by user X, the first packet (packet 1) goes to the switch A. Following a set of prescribed routing rules, switch A transmits packet 1 towards its destination (switch D) via switch B. Immediately after the second packet (packet 2) is sent to switch A, it follows the same route as packet 1 (via switch B to switch D). During this period network conditions may have changed (for instance, a large number of packets come from switch E and arrive at switch B), so the third packet (packet 3), after leaving switch A, is routed to the destination via switch C. The fourth packet (packet 4) follows the same route as packet 3, arriving at the destination switch via switch C. All four packets then are received by the user Y. [Ref. 1: p. 77]

An important aspect of packet switching operations is the acknowledgement of correctly received packets. Acknowledgement packets appear in the reverse direction from the information packets in Figure 1. Whenever an information packet is correctly received by the next switch along the path toward the destination, an acknowledgement packet is sent back to the previous switch. After the sending switch receives an acknowledgement, it knows that the information packet has been received correctly by the next switch. If an acknowledgement is not received within a certain time, the sending switch assumes that the packet was not received correctly and retransmits the packet. This assumption is necessary because a transmitted packet could be so badly garbled that the receiving switch could not make enough sense from it to intelligently ask for a retransmission. Of course, if a packet is received with only minor errors, the receiver can request retransmission prior to the end of the default retransmission cycle. The acknowledgement process ensures the integrity and the accuracy of transmitted data. [Ref. 1: p. 78]

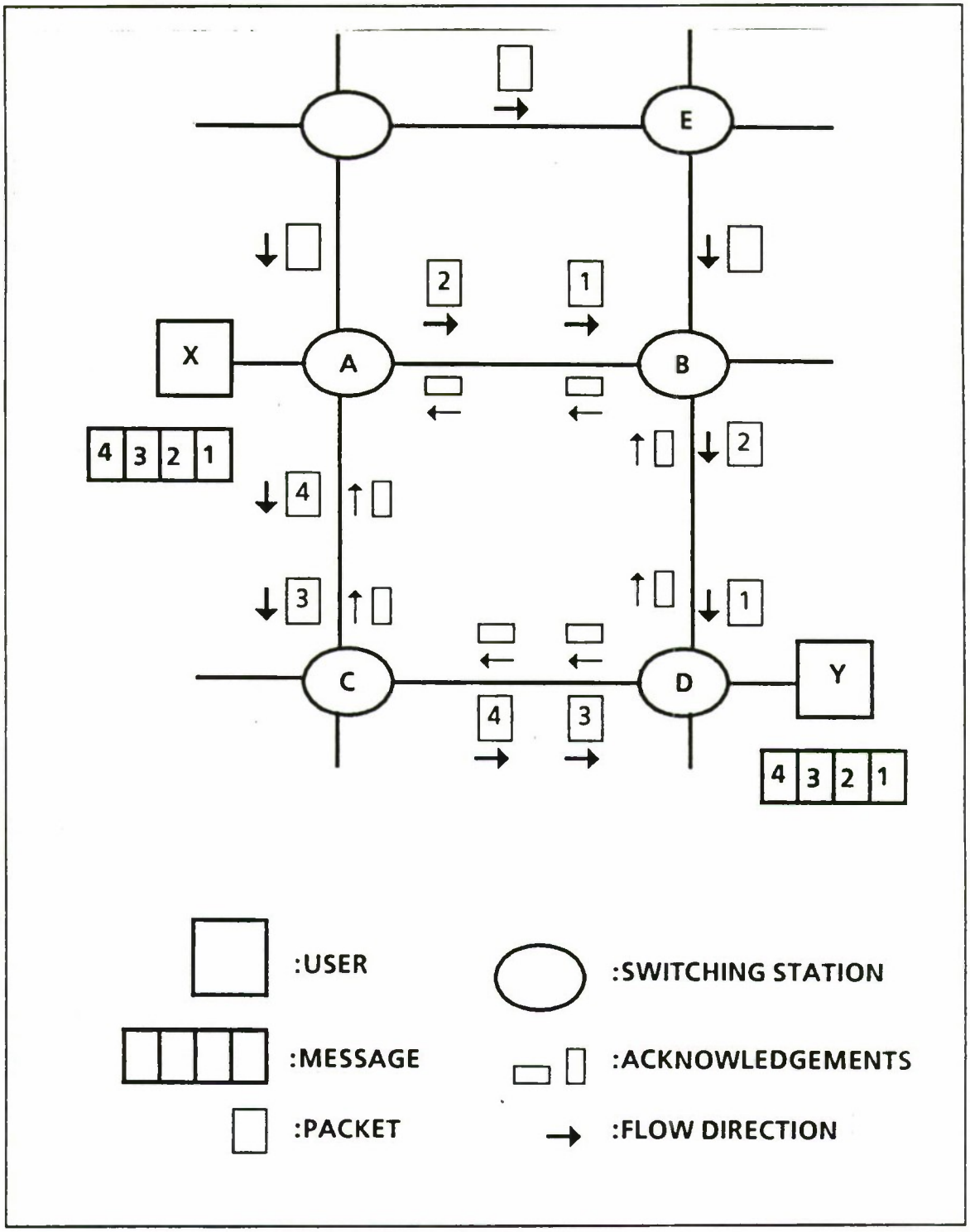

Figure 1. Basic Network Operation.

2. Network Induced Errors

There are several induced problems that can occur in a packet switching network of which packet sequencing, packet loss and packet duplication are the most significant.

Packet sequencing errors are caused by the delays experienced by packets as they travel differing paths in the network prior to reaching their destination. Retransmission of packets due to garbled messages can also induce sequencing errors. Figure 2 shows the same network but one which has experienced packet sequencing problems. Packets 1 and 2 are routed to the destination (switch D) via switch B. Packet 3 and 4 are routed via switch C. Packet 4 is received by switch C and is transmitted to the destination as before. However, during the transmission of packet 3 from switch C to switch D, an error occurs in packet 3. This now requires switch C to retransmit packet 3 to switch D. Finally, all four packets are received at the destination but with a different ordering compared to the original message transmitted by switch A.

To correct this problem, the packets must be reassembled in the same order in which they were transmitted. The process of packet reassembly is completed at the destination switch using packet sequence information (such as a serial number) contained in the packet header which preceeds each packet. [Ref. 1: p. 78]

Packet loss primarily occurs when a switch fails; however, lightning storms and timing errors can also create losses. Figure 3 shows the same network except that it has experienced a switch failure. User X enters the first packet into the network via switch A. Switch A then transmits packet 1 to switch B. After packet 1 is received correctly at switch B, an acknowledgement is retransmitted back to switch A. At the same time, packet 2 is transmitted from switch A to switch B. Again, after receiving packet 2 correctly, switch B immediately transmits an acknowledgement back to switch A. However, after switch B successfully transmits packet 1 to switch D, and before it tries to transmit packet 2, switch B fails. Having received acknowledgements for packets 1 and 2, switch A assumes that switch B has received them correctly and is no longer concerned about them. Soon thereafter, the network discovers that switch B has failed. As a result, when switch A begins to transmit packets 3 and 4 it selects another route, via switch C, to the destination. Packets 3 and 4 are received correctly at the destination switch, but packet 2 was lost when switch B failed since it could not relay packet 2 through the network.

There are several ways to avoid this problem. A switch may be required to send an acknowledgement only after it has actually forwarded the packet on to the next station, or perhaps, the originating switch may be assigned unlimited responsibility for the

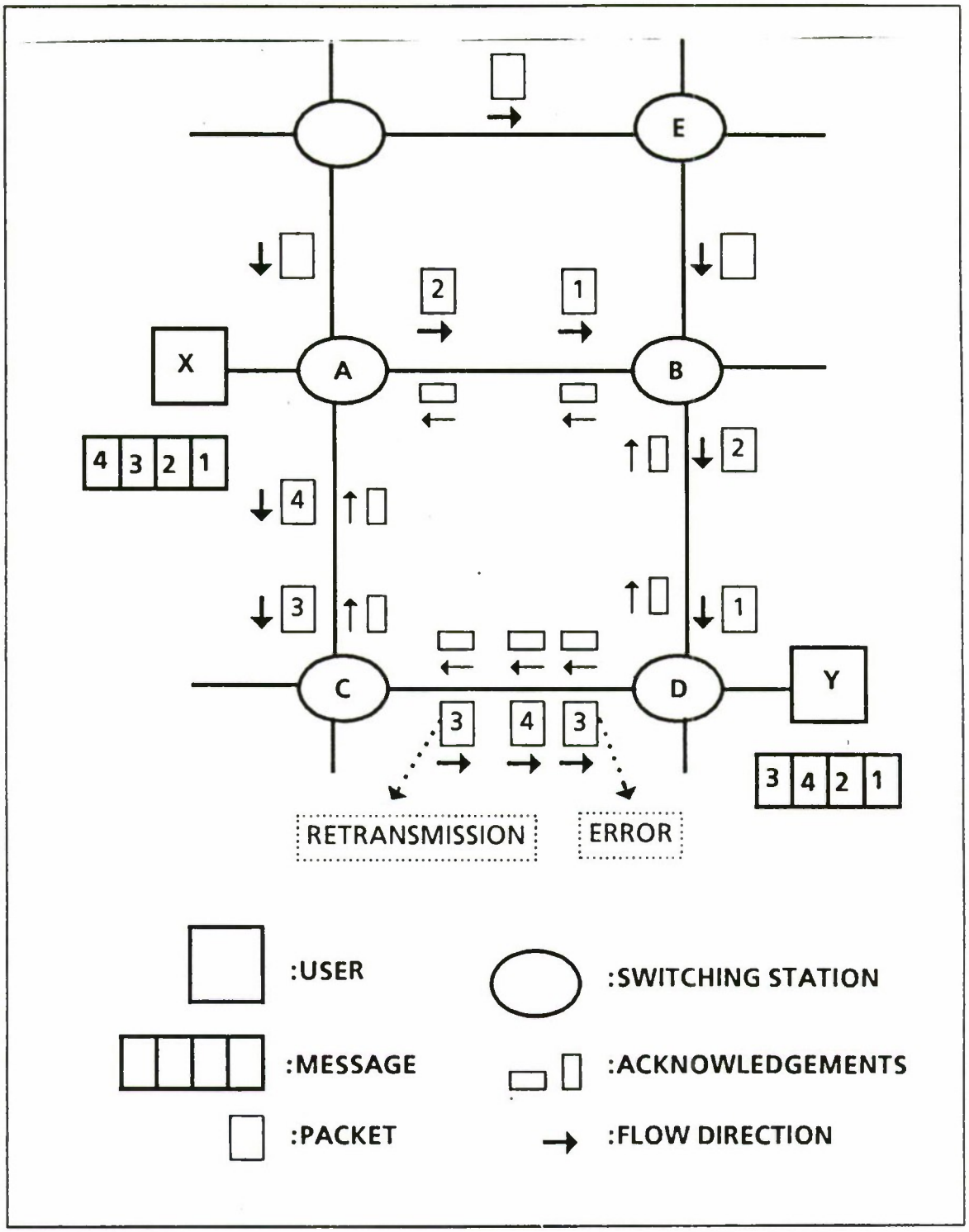

Figure 2. Packet Sequencing Problem.

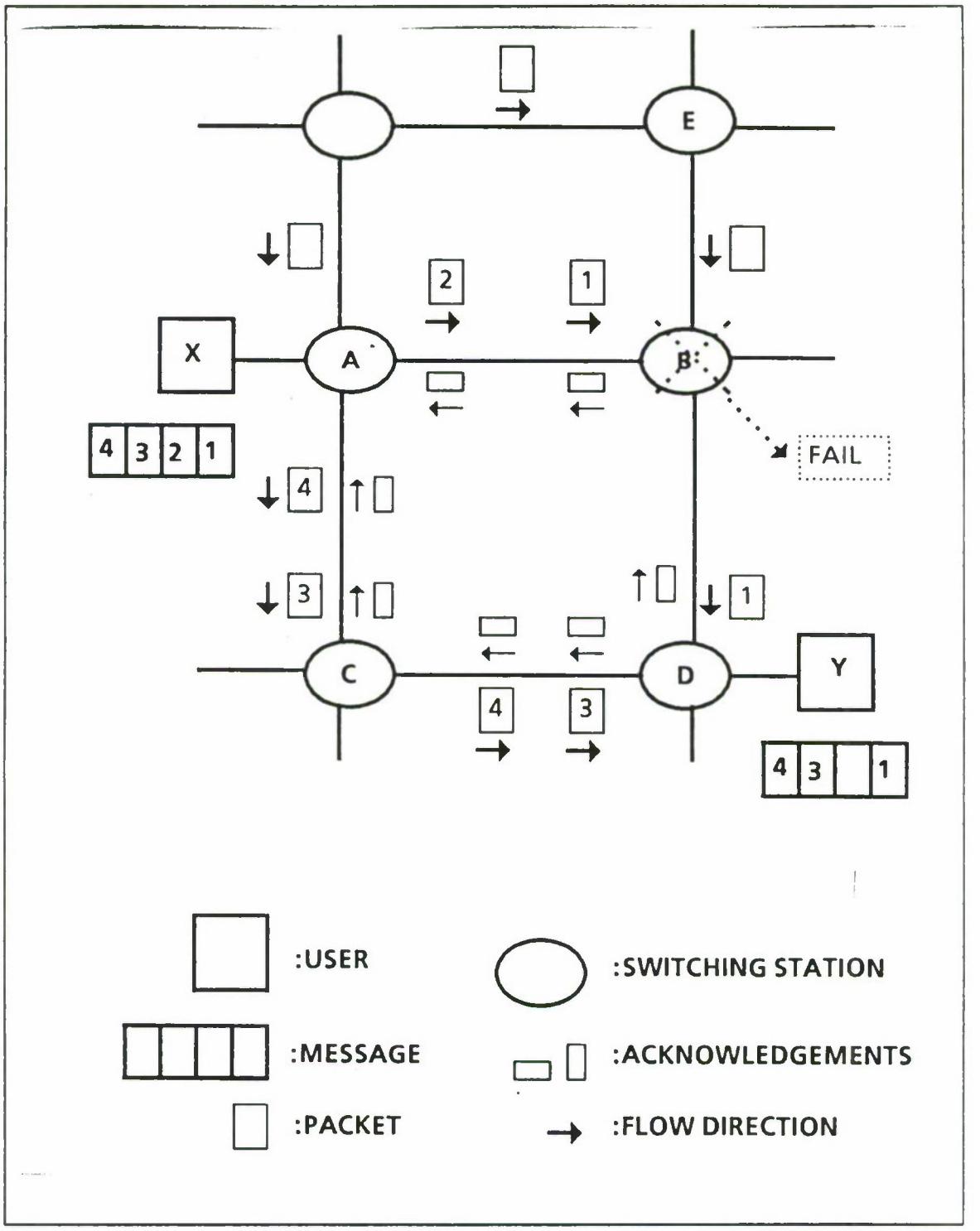

Figure 3. Packet Loss (Due to switch failure).

packets it has transmitted. Or, the original transmitting switch may be required to retransmit missing (lost) packets whenever the destination discovers them missing and requests retransmission. [Ref. 1: p. 79]

Packet duplication may result from line failure or system over-congestion. Figure 4 again shows the same network except a line failure has occured. User X enters the first packet into the network via switch A. Switch A then transmits packet 1 to switch B. At the same time, packet 2 is received correctly by switch A. After receiving packet 1 correctly, switch B transmits an acknowledgement back to switch A. Again, packet 2 was transmitted from switch A to switch B. After receiving packet 2 correctly, switch B transmits an acknowledgement back to switch A. However, just at the time the acknowledgement of packet 1 successfully arrives at switch A and the acknowledgement of packet 2 is still enroute to switch A, the communication line between switch A and switch B fails. This line failure results in exceeding the cycle time for retransmission of packet 2 since an acknowledgement has not been received. So, switch A retransmits packet 2 (since the failed communication line is detected by the network) via switch C as well as the originals of packets 3 and 4. Note that the first transmission of packet 2 was actually received correctly by switch B, even though the acknowledgement packet was destroyed due to the line failure. Thus, switch A never receives an acknowledgement. Switch B transmits packet 2 to the destination switch as usual, but switch D now receives two copies of packet 2 vice one.

A simple protection against this type of error might be to acknowledge successful acknowledgements; but this may lead to acknowledging the acknowledgements of acknowledgements, creating a hopelessly endless loop. [Ref. 1: p. 81]

3. Network overhead

a. Packet Switching Delays

Packet switching delays, the most fundamental type of overhead, result from the fact that a message of M bits is divided into multiple packets of P bits. If we discount overhead, the packet switching delay inherent in the network can be calculated. After the first packet is transmitted from the originating terminal to the originating switch, the originating switch relays the first packet to the next switch, which then relays it to the subsequent switch, and so on, until the first packet goes to the destination switch. However, while the first packet is being relayed by the originating switch, the second packet is being transmitted from the original terminal to the original switch. As soon as the originating switch has completed relaying the first packet, it should have received the second packet. It can begin relaying the second packet while it is receiving

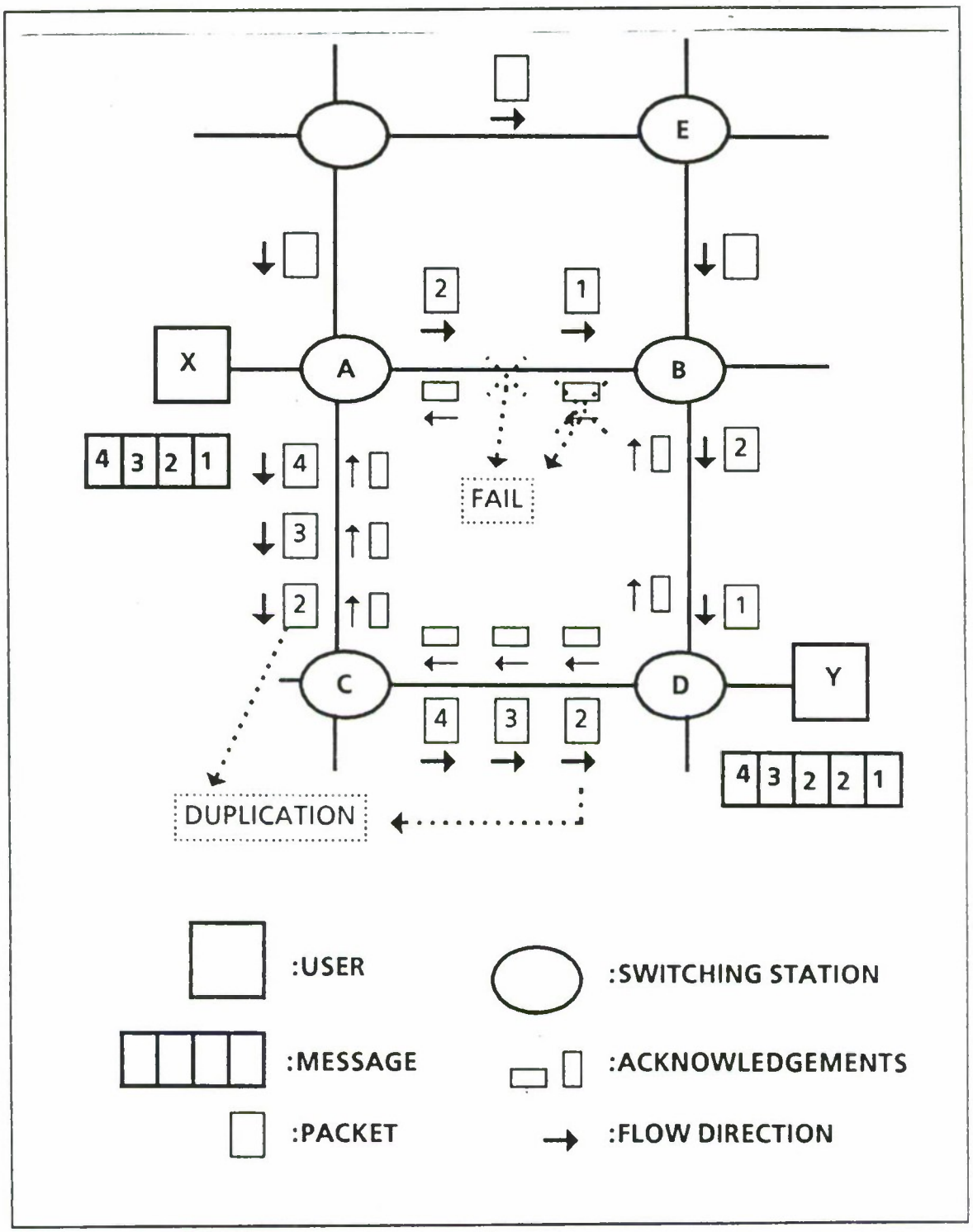

Figure 4. Packet Duplication (Due to line failure).

the third packet, and so on. If R is the line transmission rate (bits per second) and P is the number of bits in each packet, then each relay in the switching network takes P/R seconds. If there are N+1 relays between the originating and destination users, the delay for the first packet is thus P*(N+1)/R. After the first packet arrives at the destination terminal, there are (M-P) bits of the message which have not arrived at the destination terminal. However, if the network has been operating properly, and there has been no queuing delay at the intermediate switches, the second packet should be at the the destination switch ready for final transmission at the time that the first packet has been received by the destination terminal. The delay for the remaining (M-P) bits after the first packet is received at the destination terminal is thus (M-P)/R. Since a sequence of events similar to those for the second packet should occur for all subsequent packets, the total packet switching dalay is (p*N+M)/R. [Ref. 1: p. 87]

From the examples above it should be apparent that packet switching delays are a combined function of network size, architecture and system congestion. For a given network size and architecture the minimum packet delays for an optimal route, in an uncongested system, can be calculated. However, packet delays in a busy network can not be so readily computed.

b. Operational Overhead

In order to ensure that switches operate properly during message transmission and to protect against network induced errors, a certain amount of *overhead* information is necessary. The amount of overhead is heavily dependent on the network architecture and the switching protocols employed. Message specific information (packet ID or sequence number, source, destination etc.) is appended to the packet. Network specific information (packet acknowledgements, routing data, system performance data etc.) is conveyed via self contained packets flowing among the switches. [Ref. 1: p. 81]

The user's information segment consists of a segment leader, information field, and error control block. The leader contains the destination address to which the segment is to be delivered and control information required by the network. [Ref. 1: p. 83]

The packets, which flow among the switches, contain framing patterns to designate the beginning and end of each packet, a packet header, information field, and an error-control block. The packet header contains all the information that the segment leader contains as well as other information such as : source address, packet sequence number, and control blocks (to prevent looping, loss, or duplication of packets). All this

is needed by the switches for controlling the movements of the packets through the network. The contents of the control information are usually the segment sequence number, logical channel number (used to separate user information that has been multiplexed together), designation of the first or last segment of a transaction, and a wide range of protocol information related to user-to-user control of the circuit. [Ref. 1: p. 83]

4. System performance

The primary aspects of network performance that concern system managers and users alike are network integrity, reliability, throughput, accuracy, cost and efficiency. Network integrity includes maintaining connectivity between communication lines, restoring network failures and ensuring overall system reliability. [Ref. 1: p. 141]

Fundamentally, network performance can be viewed from two different perspectives; the network provider and the network user. From the point of view of the provider, network utilization is the key measure of system performance. However, from the user's perspective, basic satisfaction with network service is the underlying measure for system performance. To illustrate this point, suppose that there is only one communication line in the network and, furthermore, that the line is only open one hour per day. Everyone who desires to use the network knows the exact time that the network is open. Now the two different perspectives of system performance can be demonstrated

.

First, suppose that whenever users decide to communicate that they remain connected for the full hour that the system is open. That is, once a single user is granted access to the network no other user may utilize network services. This situation viewed from a network subscriber's point of view is, obviously, unsatisfactory. However, from the viewpoint of the network management there has been 100% utilization of the network. Next, suppose that instead of a single user holding access for a full hour, that access is only granted for 5 minutes. Furthermore, suppose that after the first user relinquishes network access, the next user immediately is granted access. If 12 users are granted access within the hour, system utilization is still 100% but user satisfaction is much higher. This example is overly simplified since 100% utilization is seldom achieved in real world networks. Yet, it does serve to demonstrate that from whatever perspective system performance is measured, system efficiency is a key factor in measuring of network performance. [Ref. 1: p. 55]

Typical networks are, obviously, not this simplistic and deal with multiple users who are often multiplexed in order to permit simultaneous access to the network.

Gaining access to the network is a function of the specific protocol employed by the network to which access is desired. In a network with sufficient resources available and a large number of users, access to the network appears to be a random process; since users are not generally restricted to specific times in accessing the system. It is this apparent random nature of network access that suggests the use of statistical methods to determine system performance.

III. SIMULATION CONSTRUCTION AND ASSUMPTIONS

A. OVERVIEW OF NETWORK SIMULATION

The packet switching network being modelled consists of a single receiver and transmitter with numerous switches and relays in between. The model is simplified by using a *virtual network* to replace all the individual switching nodes between the receiver and transmitter.

The virtual network is implemented by using a simple exponentially distributed network transit function, with a mean transit time of λ, under the assumption that all packets are identical and transit the network via different independent paths. Using a large value for λ in the model equates to a very large and complex collection of switches and relays found in real packet switching networks.

The *transmitter* is used to introduce new messages or retransmit existing messages into a virtual network. Message are initiated according to a Poisson process with rate α, that is, the message interarrival time between messages has an *exp*onential distribution with mean $(1 / \alpha)$. The number of packets (J) per message is variable and may be preset prior to running the simulation in order to determine the effect of message size on system performance. It is assumed that all J packets of a message are transmitted simultaneously from the transmitter buffer into the virtual network.

The *receiver* is used to receive messages from the virtual network. The receiver's buffer (B) can accomodate M messages (or $B = M \times J$ packets). The first packet of a new message to arrive at the receiver captures the buffer and reserves room for itself and the remaining (J-1) packets of the message. The time interval from initial transmission of a message to the moment that the buffer is captured is called the *capture time*.

Once room in the buffer has been captured these J slots are not relinquished until all packets, of that particular message, have been received. Other packets from different messages either find there is sufficient room available in the buffer to capture J packets for their message or find the buffer is full. If the buffer is full, all packets (from messages not holding a reservation) that arrive between capture and relinquishment are considered lost. When a complete packet is received, an acknowledgement signal is sent to the transmitting station, all necessary data is collected and the message is purged from the receiver buffer (however any duplicate packets still remain in the virtual network).

If no acknowledgement is received by the transmitter in time interval δ (the retransmission interval), each packet which has not been received at the receiving station is re-transmitted; this action is repeated until acknowledgement occurs. In a real packet switching network this may be necessary because packets may encounter severe congestion in the network, may be destroyed by collision (simultaneous arrival at the receiving station) or be lost when encountering a full receiver buffer.

The model makes no attempt to account for packet losses which may occur between the transmitter and receiver in an actual packet switching network. However, since transit times generated by the computer may result in duplicate arrival times a simple model for receiver buffer collision is incorporated in the simulation. This is, of course, an implementation issue and the frequency of collisions may vary significantly with the precision of the computer.

B. BASIC SIMULATION OPERATION

The simulation is event driven, that is, it uses a master work schedule to schedule events. Events considered in this model are : the time to initiate a new message, the time to retransmit a message and the arrival time of each packet at the receiver.

A time stamp is used to indicate when an event has occured. Random events are generated by GGEXN (the EXPonential Random Deviate Generator included in the IMSL library). Random message interarrival times at the transmitter are generated using GGEXN by passing the mean interarrival time ($1 / \alpha$) as a parameter. The transit time is obtained in a similar fashion, by passing the mean transit time (λ) as a parameter. The time at which a packet arrives at the receiver buffer is the sum of the packet's most recent transmission time plus a random transit time. The simulation halts when sufficient data has been collected or when a predetermined number of messages have been transmitted.

A simplified version of the algorithm used in the simulation is illustrated in Figure 8 on page 18 through Figure 11 on page 21 (conditional statements are represented by code segments bordered with dashed lines).

Sufficient memory is reserved during the initialization segment of the program to allocate a message data record for each message that will be injected into the network. Figure 5 on page 15 illustrates the conceptual notion of an indexed set of message data records stored in computer memory. Figure 6 on page 16 is an isolated view of a single message data record which shows that each record contains a header with four fields, a collection of packet data records (one set for each packet of the message - in this case

4 packets) and a trailing field which holds the time of earlist arrival for each packet. The contents of the individual packet data records are illustrated in Figure 7 on page 17. Each packet data record holds the scheduled arrival time at the receiver buffer, for that packet, and a packet status flag. The packet status flag is used to indicate whether the data in that record must still be retained or whether it may be discarded. The message status flag is used to indicate whether a message has reserved room at the receiver buffer, has been received completely, or has no more packets remaining in the virtual network.

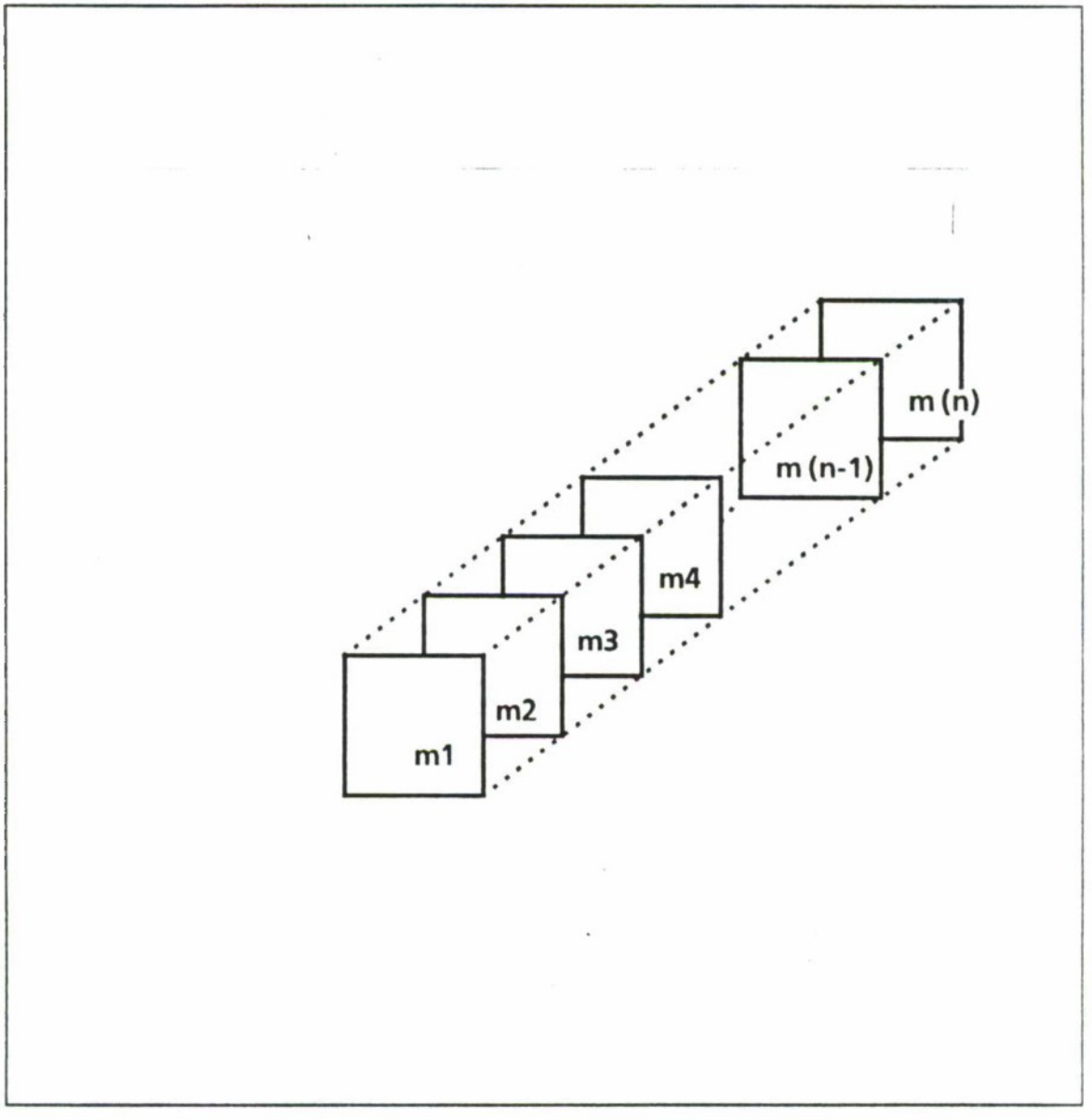

Figure 5. Conceptual view of message data records stored in memory.

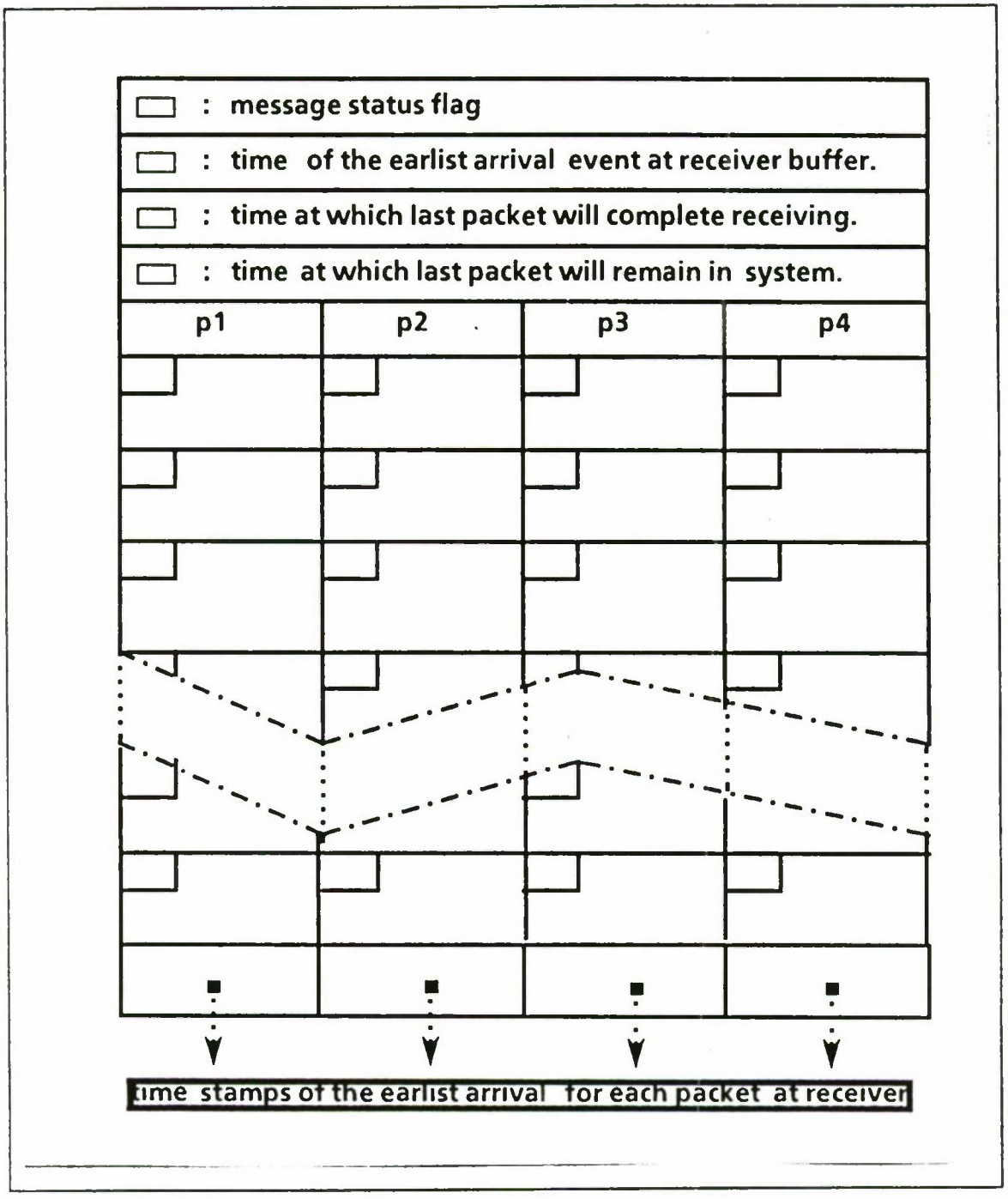
: message status flag
: time of the earlist arrival event at receiver buffer.
: time at which last packet will complete receiving.
: time at which last packet will remain in system.
p1
p2
p3
p4
time stamps of the earlist arrival for each packet at receiver

Figure 6. Conceptual view of a single message data record.

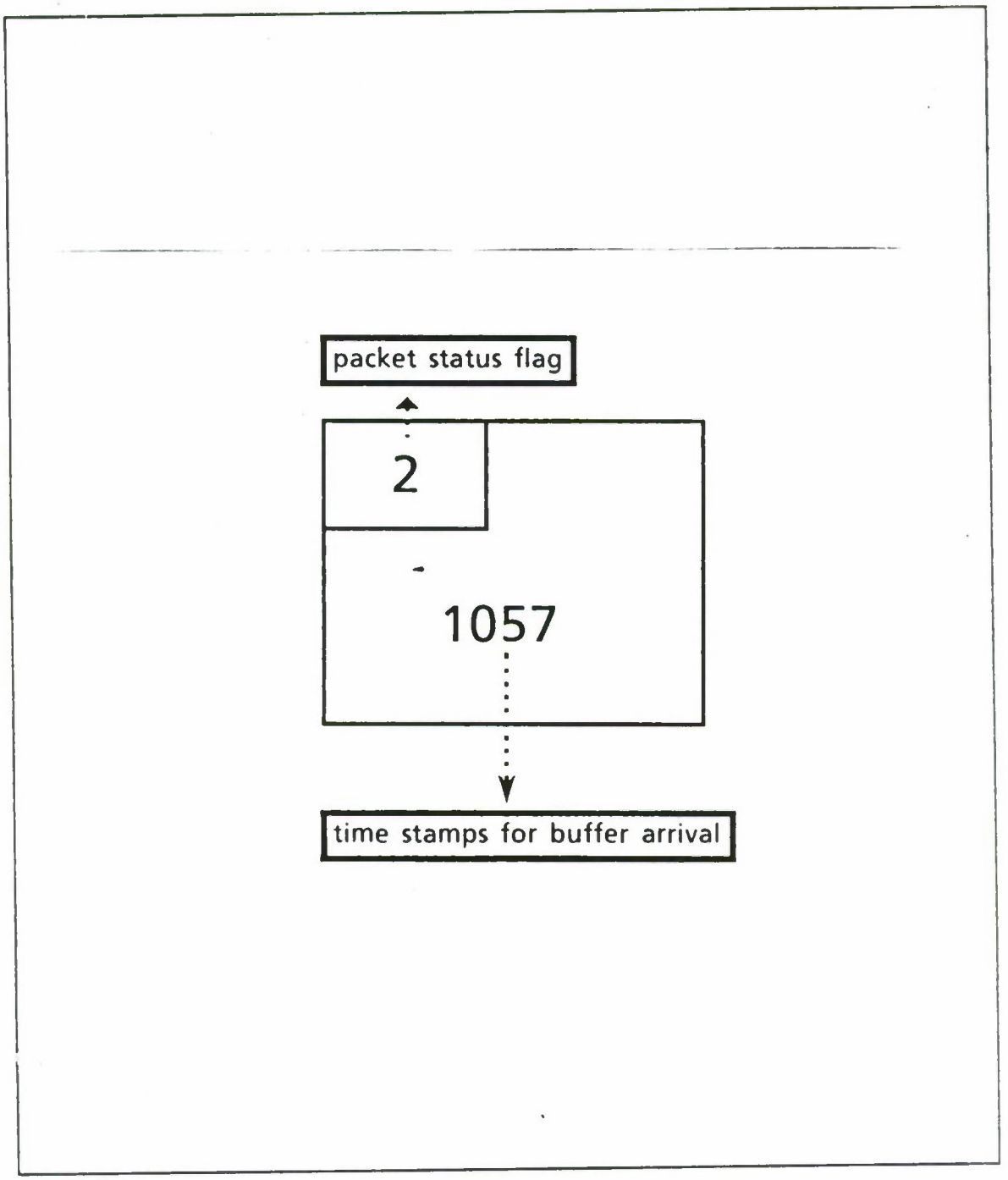

Figure 7. Conceptual view of a packet data record.

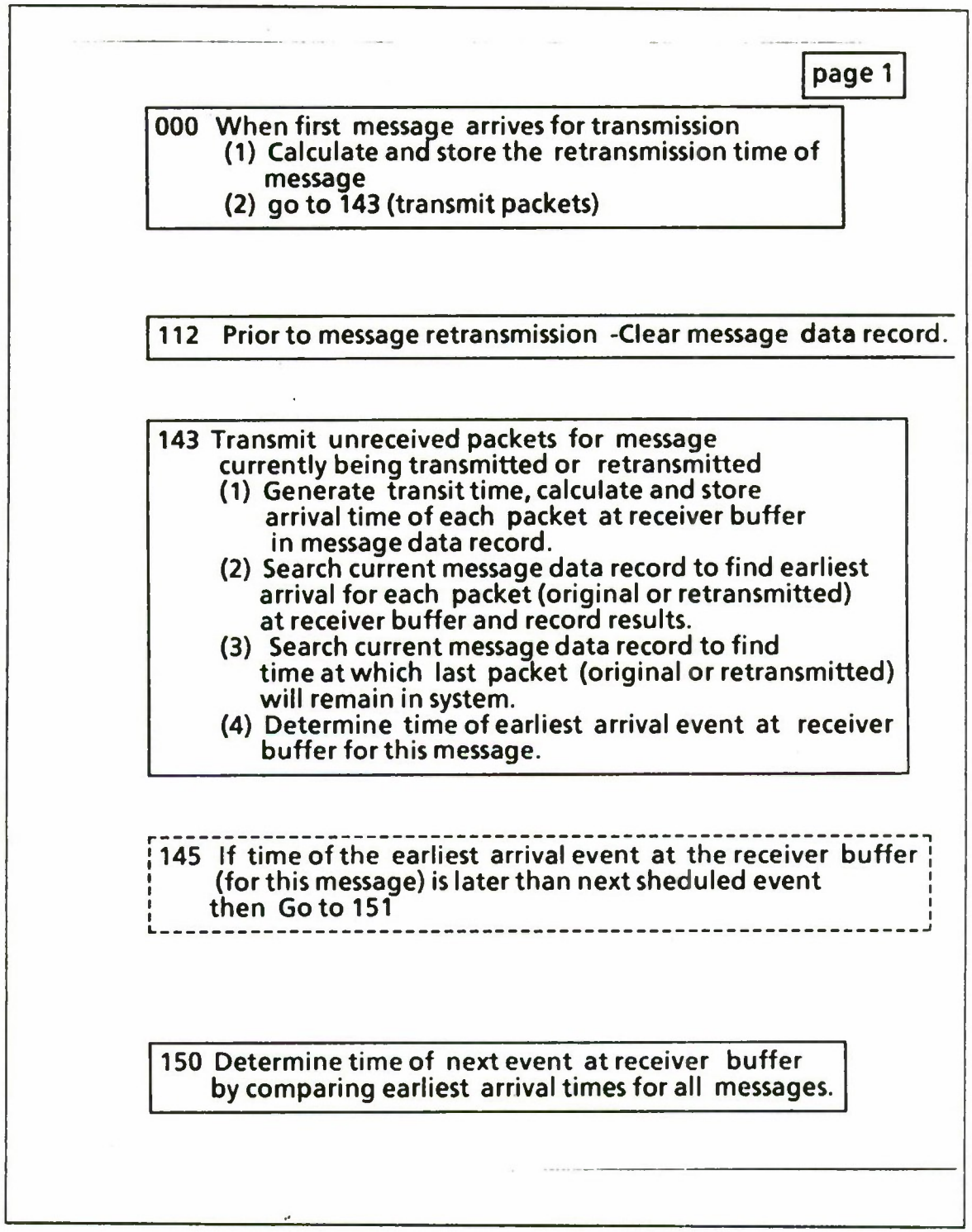
page 1
000 When first message arrives for transmission
(1) Calculate and store the retransmission time of message
(2) go to 143 (transmit packets)
112 Prior to message retransmission -Clear message data record.
143 Transmit unreceived packets for message currently being transmitted or retransmitted
(1) Generate transit time, calculate and store arrival time of each packet at receiver buffer in message data record.
(2) Search current message data record to find earliest arrival for each packet (original or retransmitted) at receiver buffer and record results.
(3) Search current message data record to find time at which last packet (original or retransmitted) will remain in system.
(4) Determine time of earliest arrival event at receiver buffer for this message.
145 If time of the earliest arrival event at the receiver buffer (for this message) is later than next sheduled event then Go to 151
150 Determine time of next event at receiver buffer by comparing earliest arrival times for all messages.

Figure 8. Simplified Algorithm of the Simulation.

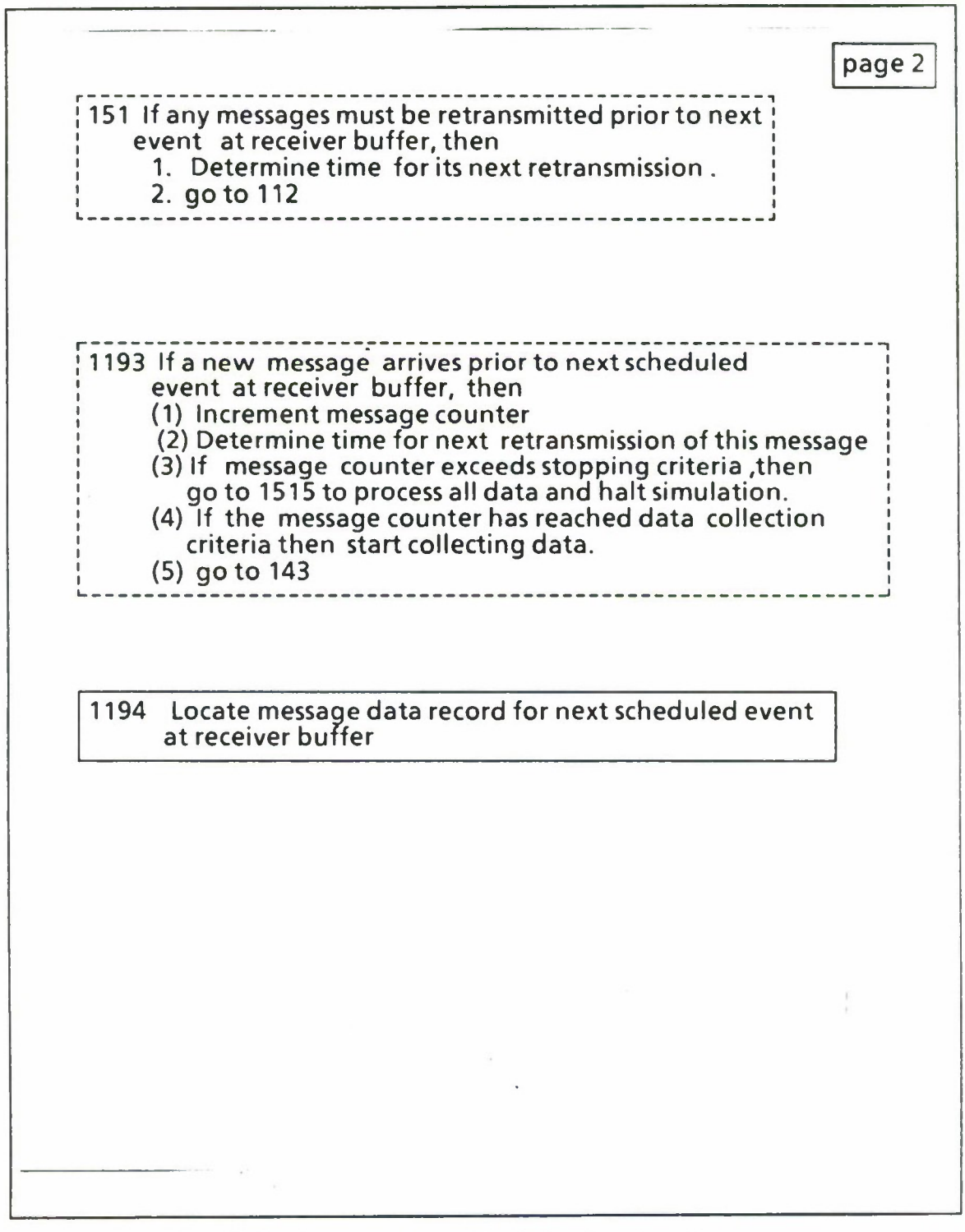
page 2
151 If any messages must be retransmitted prior to next event at receiver buffer, then
1. Determine time for its next retransmission .
2. go to 112
1193 If a new message arrives prior to next scheduled event at receiver buffer, then
(1) Increment message counter
(2) Determine time for next retransmission of this message
(3) If message counter exceeds stopping criteria ,then go to 1515 to process all data and halt simulation.
(4) If the message counter has reached data collection criteria then start collecting data.
(5) go to 143
1194 Locate message data record for next scheduled event at receiver buffer

Figure 9. Simplified Algorithm of the Simulation (continued).

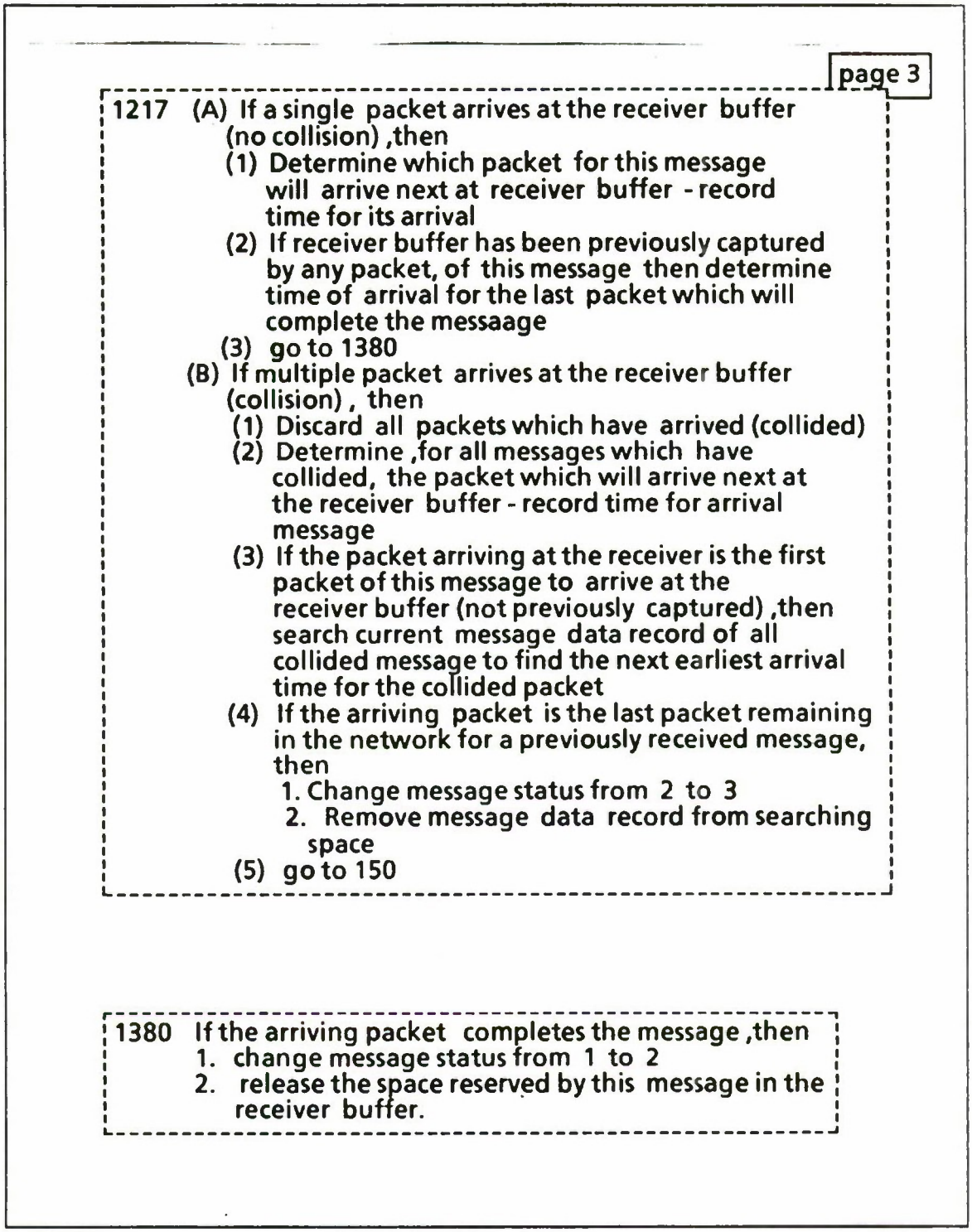
page 3
1217 (A) If a single packet arrives at the receiver buffer (no collision) ,then
(1) Determine which packet for this message will arrive next at receiver buffer - record time for its arrival
(2) If receiver buffer has been previously captured by any packet, of this message then determine time of arrival for the last packet which will complete the messaage
(3) go to 1380
(B) If multiple packet arrives at the receiver buffer (collision) , then
(1) Discard all packets which have arrived (collided)
(2) Determine ,for all messages which have collided, the packet which will arrive next at the receiver buffer - record time for arrival message
(3) If the packet arriving at the receiver is the first packet of this message to arrive at the receiver buffer (not previously captured) ,then search current message data record of all collided message to find the next earliest arrival time for the collided packet
(4) If the arriving packet is the last packet remaining in the network for a previously received message, then
1. Change message status from 2 to 3
2. Remove message data record from searching space
(5) go to 150
1380 If the arriving packet completes the message ,then
1. change message status from 1 to 2
2. release the space reserved by this message in the receiver buffer.

Figure 10. Simplified Algorithm of the Simulation (continued).

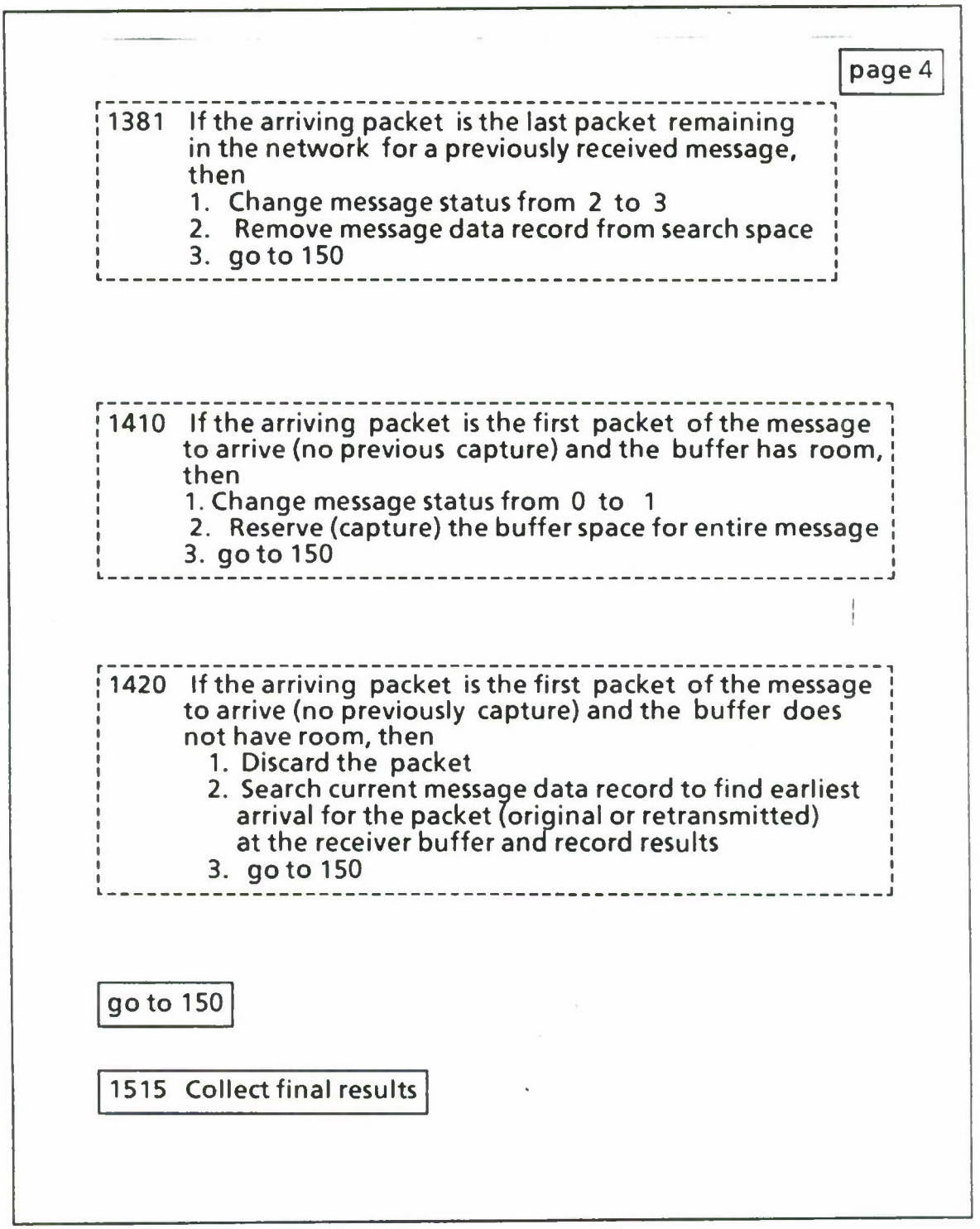
page 4
1381 If the arriving packet is the last packet remaining in the network for a previously received message, then
1. Change message status from 2 to 3
2. Remove message data record from search space
3. go to 150
1410 If the arriving packet is the first packet of the message to arrive (no previous capture) and the buffer has room, then
1. Change message status from 0 to 1
2. Reserve (capture) the buffer space for entire message
3. go to 150
1420 If the arriving packet is the first packet of the message to arrive (no previously capture) and the buffer does not have room, then
1. Discard the packet
2. Search current message data record to find earliest arrival for the packet (original or retransmitted) at the receiver buffer and record results
3. go to 150
go to 150
1515 Collect final results

Figure 11. Simplified Algorithm of the Simulation (continued).

C. GENERAL DESIGN CONSIDERATIONS

In order for the simulation to provide meaningful statistical data, sufficient messages must be injected into the virtual network. Since every message and each packet must be assigned its own data record, memory constraints can quickly become a significant issue. Memory demands grow in a nonlinear fashion with every new message added. This problem is compounded by the additional memory absorbed for each retransmitted packet. As system congestion increases, the number of retransmitted packets grows rapidly; once again driving memory demands quickly towards system capacity.

The data records for messages and packets are implemented in large arrays (since Fortran does not provide for dynamic record structures) and must be declared at the begining of the program as static arrays. This requires that individual packet data records be identified for future reuse. Data collection requirements also dictate that the simulation reserve room for and perform *on-the-fly* analysis for each iteration executed.

A rough estimation of the memory required for three thousand messages of five packets each is on the order of 2.5 megabytes. For the same number of messages with nine packets per message, the memory required jumps to 4.5 megabytes. With a six megabyte limitation imposed by the system used for running the simulation , careful data record management becomes a critical issue.

It is not difficult to see that internal record management functions become extremely memory and time intensive as message size and system congestion increase. The C.P.U. time required then, is not only a funetion of the data collection which must be performed on each paeket, but is also heavily influeneed by reeord management overhead.

D. SIGNIFICANT VARIABLES AND PARAMETERS OF INTEREST

Some of the basic variables found in actual packet switching networks were modelled in order to gain insight into their impact on system congestion. These variables inelude the message interarrival time, network transit time, message retransmission time, receiver buffer size and message size.

Interarrival time refers to the average time between message arrivals at the transmitting station. This is a local measurement which indicates how busy a transmitter station may be; however, it provides no information about the general condition of the overall network. In this simulation we are primarily concerned with large database transmissions, therefore, judicious selection of the interarrival time to create a backlog at the transmitter can be used to simulate a constant supply of data packets available for transmission.

Transit time refers to the time it takes for a message packet to travel from the transmitting station to the destination. Since each packet may take a different route to the destination, the transit time may vary for each packet of a message. Recall, that transit time, in a real network, is affected by switch retransmissions, line delays and inherent packet switching delays.

Retransmission time refers to cycle time between transmissions of unreceived packets. Adjustment of the retransmission rate/time may have a significant impact on overall system congestion since retransmitted packets can be viewed as additional messages entering the network.

Receiver buffer size refers to the space available in the receiver buffer for holding messages. The receiver buffer may hold a single message or several messages simultaneous. A receiver buffer of infinite capacity would greatly reduce system congestion; however, this is, obviously, not practical in an actual network.

Message size refers to the number of packets contained in a single message. Increased message size equates to a greater number of packets entering the network with each message transmitted and therefore should have an impact upon system congestion.

The parameters which were chosen for observation to gain insight into system congestion performance are capture time, buffer holding time and message completion time.

Capture time is defined as the time from initial transmission until a message is able to reserve space in the receiver buffer.

Buffer holding time is defined as the length of time from buffer capture until message completion.

Receiver buffer blocking is defined as the percentage of time that receiver buffer is blocked (unavailable) to new messages. Buffer blocking should provide direct insight into the effects of buffer size and message size on congestion.

Message completion time is the length of time from initial message transmission until message completion. The number of completed messages would provide a measure of system throughput but we are primarily focusing our interests on the temporal effects of each variable on system performance.

IV. RESULTS

A. DATA COLLECTION/ANALYSIS METHODOLOGY

The simulation records the time for several major events which include : (1) the initial transmission time of each message, (2) the time of arrival for each packet which was actually received, (3) the time at which the last packet completed the message and (4) duration of time that the receiver buffer was blocked to new messages. Data collection begins when the message counter reaches a specified data collection point and stops when it reaches a preset maximum. The data for each packet within every message is then recorded and analyzed.

Percentage of receiver buffer blocking, capture time, buffer holding time and message completion time are the primary statistics of interest.

In order to calculate the percentage of receiver buffer blocking, the total time that the receiver buffer was blocked is simply divided by the total elapsed simulation time.

There are two steps for finding the capture time, buffer holding time and message completion time for each message. Each message's packet data records are first searched to establish the time at which a reservation was successfully made in the buffer. Capture time is calculated by taking the difference between initial message transmission time and the initial reservation time. Buffer holding time is calculated by taking the difference between initial reservation time and the time the message was completed. Message completion time is, simply, the sum of the capture time and buffer holding time. Once capture times, buffer holding times and message completion times are obtained for each message; the statistical mean is calculated.

Additional statistics were also obtained: the average number of packets transmitted, the average number of packets re-transmitted, the average number of packet collisions at the receiver, the average number of missing packets due to the combined effects of collisions and a full receiver buffer; and, the average number of messages and packets received. These statistics are averaged over the total elapsed simulation time. The additional data were not used in the analysis, because it was felt that system performance may be sufficiently expressed by using the percentage of receiver buffer blocking, capture time, buffer holding time and message completion time. The interested reader may find this additional data in "APPENDIX B. Raw data values" on page 84.

B. TRANSIENT STATE ANALYSIS

Meaningful data can only be obtained during steady state operation of any simulation. Determining the point at which a simulation has reached steady state conditions is often unclear, especially since each variable may impact upon the time at which steady state is reached. The simulation was run using a wide range of values for each variable. Figure 12 and Figure 13 represent data obtained from a single simulation run using mid-range values and serves only as an example of how the data collection point was determined. In these figures it can be clearly seen that steady state conditions exist shortly after the 125th message is injected into the virtual network. In general, running the simulation with a wide range of values resulted in steady state conditions occuring prior to the injection of the 200th message. Therefore, it seemed reasonable to select the 500th message as the data collection point to ensure a wide margin of safety as the variables were changed.

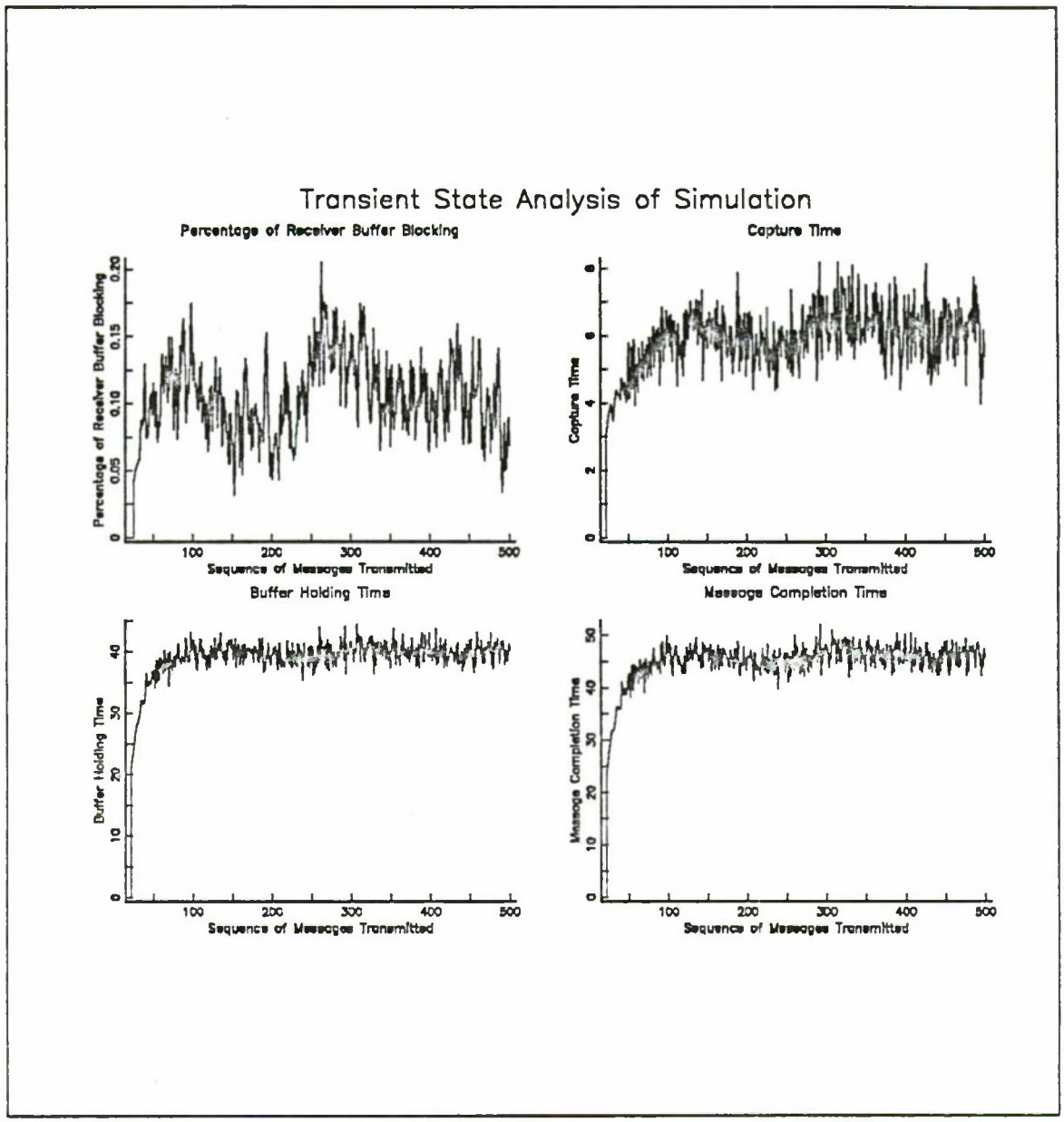

Figure 12. Transient State Analysis of Simulation (average value).

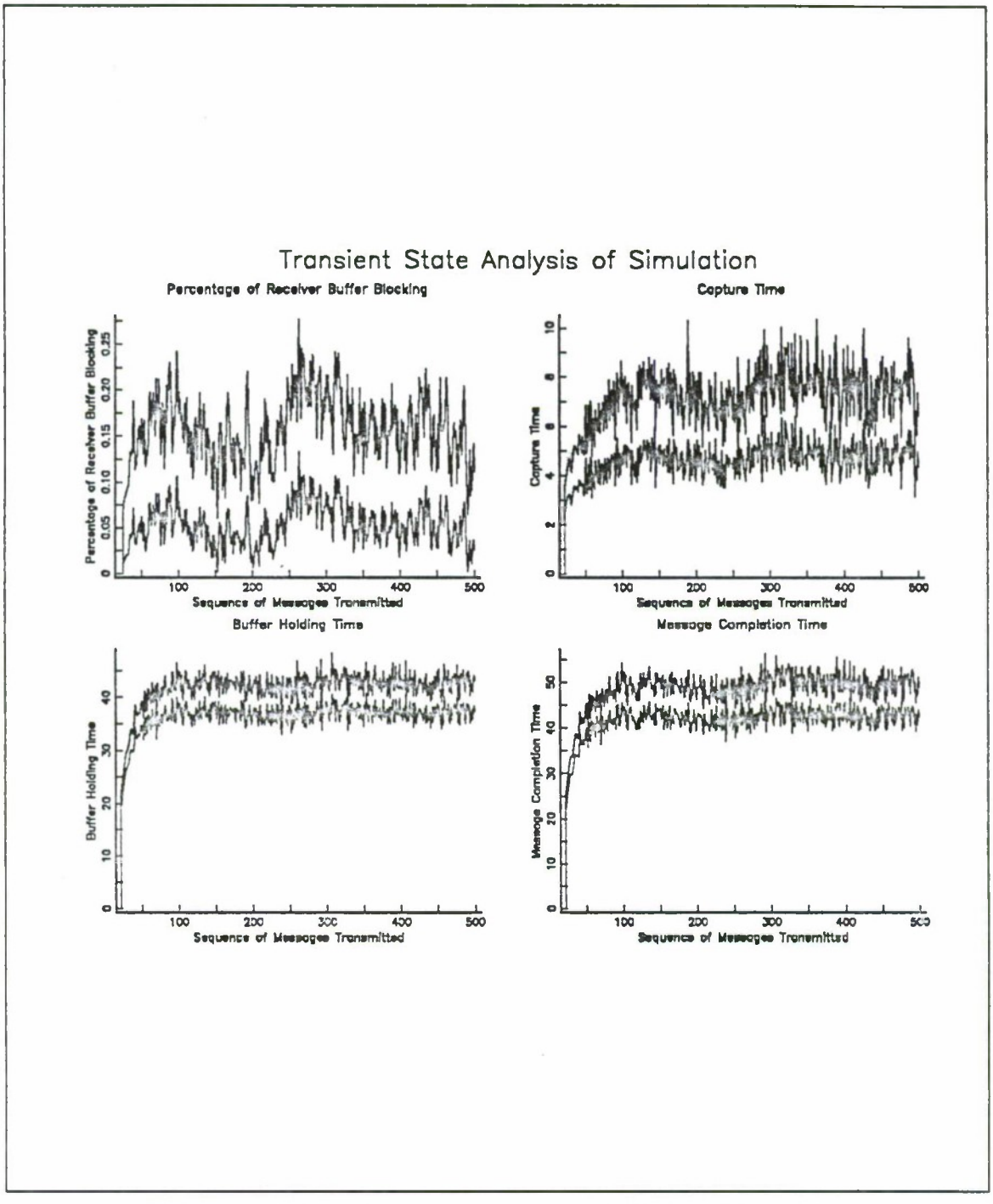

Figure 13. Transient State Analysis of Simulation (95% conf. interval).

C. SELECTION OF VARIABLE RANGES

Since the percentage of receiver buffer blocking is the ratio of the total time the receiver buffer was blocked to the total elapsed simulation time; the total elapsed time must be large enough so that the resulting fraction is a meaningful statistic. In addition, the total number of messages must also be large enough for data to be meaningful.

Varying one parameter while fixing all others was used to determine which parameter had the greatest influence on system performance. All information collected from varying a particular parameter is gathered together in one data set. The value for the starting criteria, stopping criteria and message interarrival time are discussed in the previous section. The static values for the remaining parameters, the network transit time, the re-transmission time interval, the buffer size and the message size, are discussed below.

The ratio of the mean transit time to the mean interarrival time, to some extent, directly influences receiver blocking. This should be intuitive, since a high ratio implies that messages are arriving at the transmitter faster than they can be transitted through the network. That is, there is always a backlog of messages awaiting transmission. The ratio between mean transit time and the retransmission interval also has a significant impact on system congestion. This becomes obvious when the retransmission time is less than the transit time, since this suggests messages are retransmitted before they can even transit the network. If the ratio is greater than one but not sufficiently large enough, it may mean that not enough time is available for the acknowledgement packet to arrive at the transmitter.

Receiver buffer size, as previously mentioned, directly influences receiver buffer blocking because a buffer which is too small will not permit receipt of multiple messages simultaneously. In light of the the fact that receiver buffer size was suspected to have the greatest single influence on buffer blocking, preliminary values for the other variables were established such that the system was forced to near congestion early in the simulation. This was accomplished by establishing a 12 to 1 ratio between mean transit time and the mean interarrival time and by choosing a 1 to 1 ratio between the mean network transit time and retransmission interval.

A preliminary series of runs were conducted, to examine the effect of buffer size, using 3000 messages of packet length 5. Figure 22 shows that the percentage of receiver buffer blocking changed from 0.01 to 0.93 as the range of the buffer size changed from 26 to 17 messages. Based on this preliminary data, 22 messages was selected as the fixed value size of the receiver buffer while running other data sets. The reason for selecting

this value was that receiver blocking was 0.12 and, thus, would permit a sufficient range to demonstrate the effect of other parameters on system performance.

D. DATA ANALYSIS

Table 1 through Table 8 are arranged such that the values of the six fixed variables are listed in the upper part of the table with the values for the variable parameter listed in the left column. The values in the table represent averaged values from 100 simulation runs.

Figure 14 through Figure 26 are plotted from the tables of data which immediately preceed them. The first figure in each section is a plot of the data table using the variable parameter along the X-axis. The second figure plots the same data; however, differs in that receiver buffer blocking is plotted on the X axis. All graphs from Figure 14 through Figure 26 are plotted to show 95% confidence interval based on average values.

Figure 27 through Figure 29 are composite plots grouped by category (capture time, buffer holding time and message completion time) with receiver buffer blocking plotted along the X-axis.

1. Influence of Total Number of Transmitted Messages on System Performance

Figure 14 shows that an increase in the total number of transmitted messages has little impact on system performance between 1500 and 2500 messages. However, after 2500, there appears to be a slow increase. This may be an indication that the critical mass for congestion, within the simulation, is on the order of 2500 messages.

Notice in Figure 15 that as receiver buffer blocking increases, capture time, buffer holding time and message completion time rise slowly as the total message volume increases.

Table 1. INFLUENCE OF TOTAL NUMBER OF TRANSMITTED MESSAGES ON SYSTEM PERFORMANCE.

Parameter used :					
Mes. Size	Buf. Size	Mes. Inter.	Tran. Time	Retrans. Time	Data Collect. Start point
5	22 mes.	2	24	24	500

Data obtained :				
Mes. No.	Buf. Block.	Capt. Time	Hold. Time	Comp. Time
1000	0.1084	6.0737	33.6270	39.7007

Table 2. INFLUENCE OF TOTAL NUMBER OF TRANSMITTED MESSAGES ON SYSTEM PERFORMANCE (CONTINUED).

Mes. No.	Buf. Block.	Capt. Time	Hold. Time	Comp. Time
1100	0.1058	6.0325	33.6272	39.6597
1200	0.1063	6.1643	33.6519	39.8162
1300	0.1166	6.3572	33.6918	40.0490
1400	0.1128	6.2060	33.6868	39.8928
1500	0.1080	6.0433	33.6295	39.6728
1600	0.1114	6.2602	33.7176	39.9778
1700	0.1104	6.1877	33.6730	39.8606
1800	0.1111	6.2127	33.6480	39.8607
1900	0.1080	6.1882	33.7246	39.9128
2000	0.1069	6.1384	33.7249	39.8633
2100	0.1113	6.2337	33.7226	39.9563
2200	0.1043	6.0787	33.7031	39.7818
2300	0.1143	6.3358	33.8458	40.1816
2400	0.1138	6.2480	33.8333	40.0813
2500	0.1150	6.3112	33.8770	40.1881
2600	0.1168	6.3726	33.9092	40.2817
2700	0.1151	6.3348	33.9932	40.3280
2800	0.1155	6.3693	33.9910	40.3603
2900	0.1172	6.3635	33.9919	40.3554
3000	0.1175	6.3785	33.9929	40.3714
3100	0.1258	6.5456	34.1089	40.6544
3200	0.1208	6.4656	34.0973	40.5629
3300	0.1197	6.4542	34.0586	40.5128
3400	0.1236	6.4826	34.1650	40.6476
3500	0.1159	6.4126	34.1060	40.5186
3600	0.1191	6.3877	34.1355	40.5232
3700	0.1244	6.5363	34.1603	40.6966
3800	0.1236	6.4951	34.1718	40.6669
3900	0.1225	6.4521	34.1768	40.6289
4000	0.1217	6.4406	34.1621	40.6028
4100	0.1269	6.5775	34.2540	40.8315
4200	0.1272	6.6185	34.2083	40.8268
4300	0.1278	6.5619	34.2743	40.8362
4400	0.1191	6.4532	34.1963	40.6495
4500	0.1215	6.4825	34.2321	40.7146

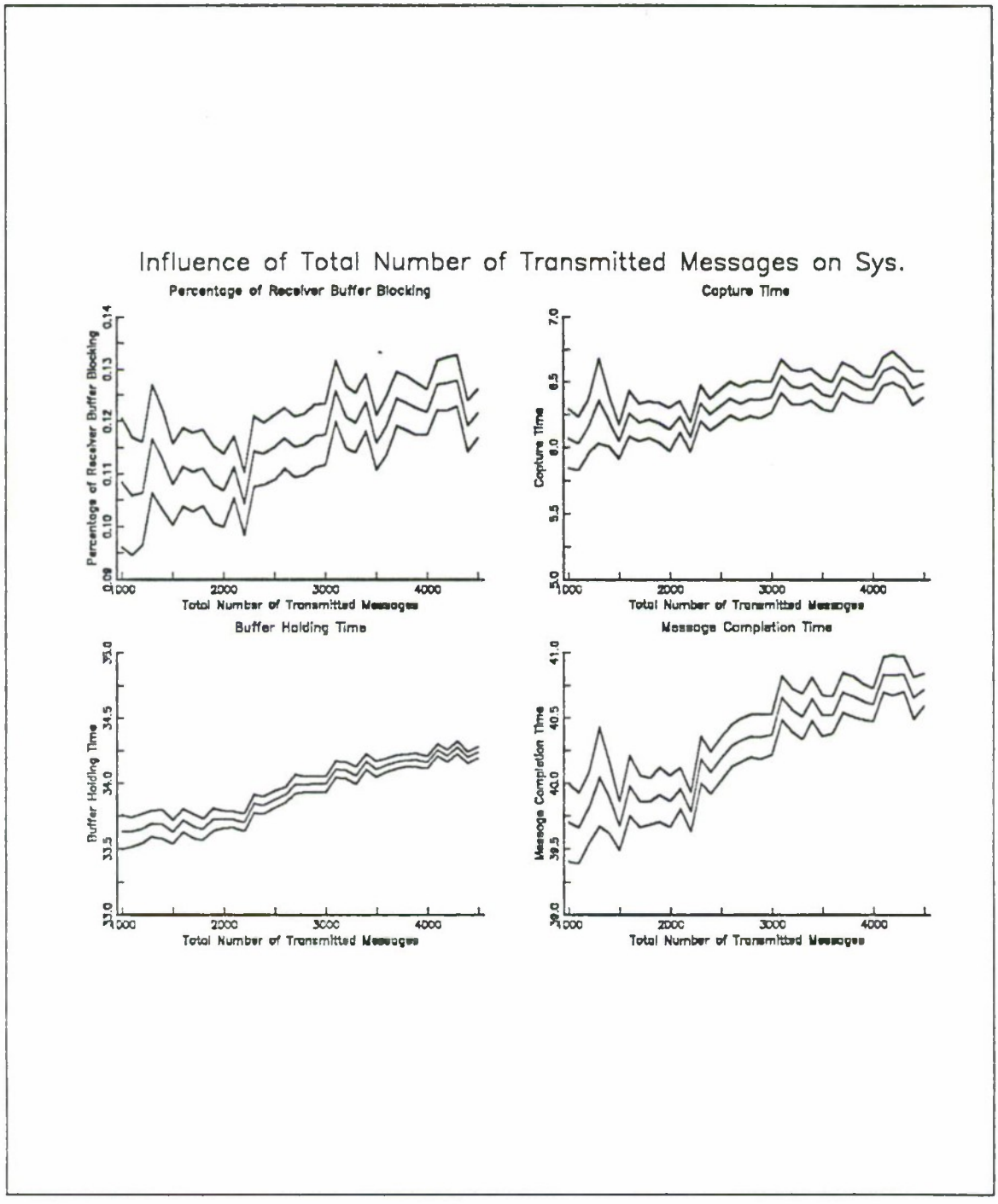

Figure 14. Influence of Total Number of Transmitted Messages on System Performance.

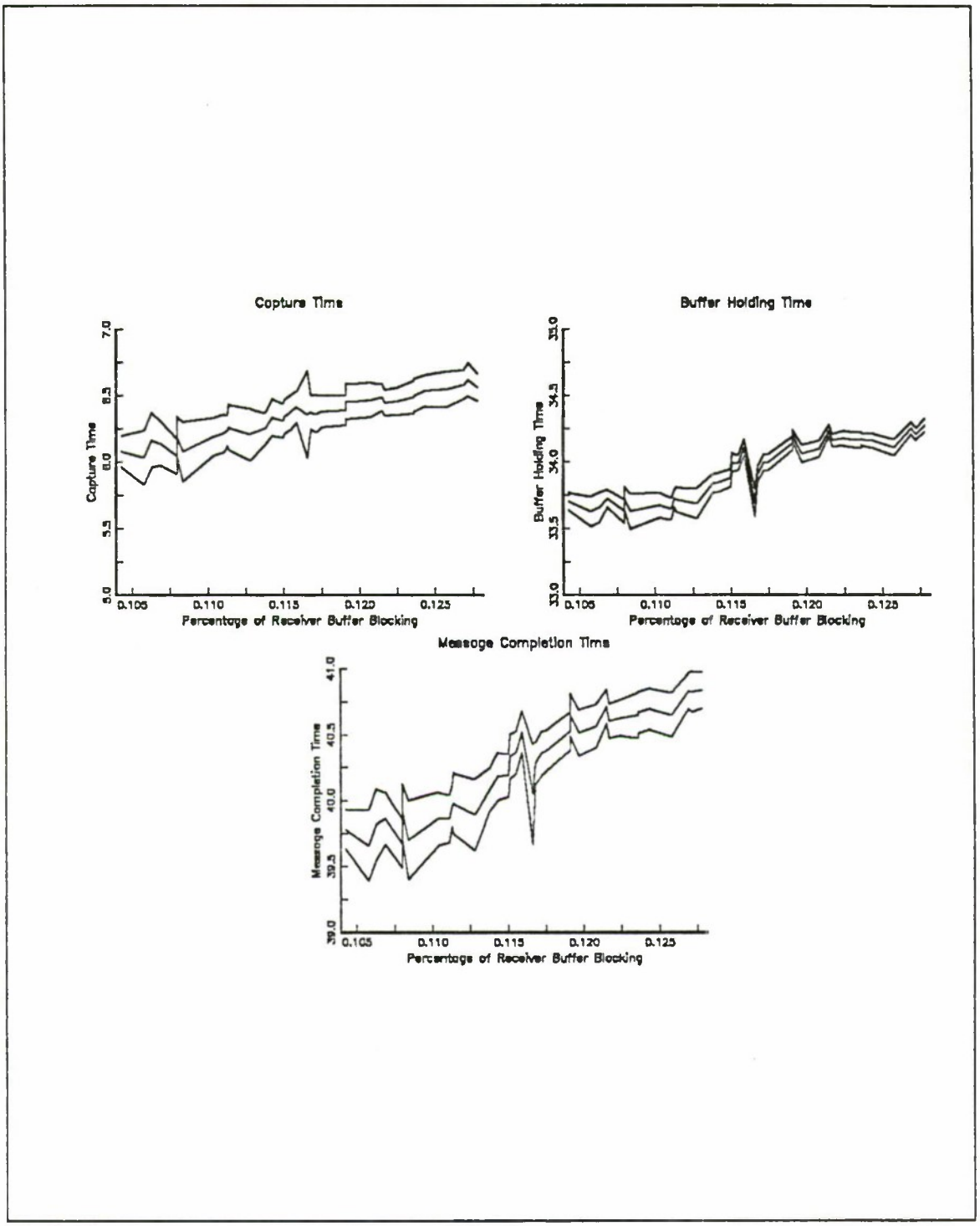

Figure 15. Influence of Total Number of Transmitted Messages on System Performance.

2. Influence of Message Interarrival Time on System Performance

Figure 16 shows that an increase in the time between message arrivals at the transmitter causes a dramatic decrease in the percentage of receiver buffer blocking, capture time and message completion time. A local maximum point appears in buffer holding time when the mean value of the message interarrival time is 1.6. This maximum is most likely a statistical anomaly of the simulation or a remnant of a start-up phenomenon, since one would normally expect a smooth curve. Notice from the data table below that capture time is influenced much more than buffer holding time when the time between message arrivals is decreased.

Notice from Figure 17 that as receiver buffer blocking increases; capture time and message completion time also increase rapidly. Once, again, a local maximum appears in buffer holding time when the percentage of the receiver buffer blocking is 0.80; however, this is most likely related to the anomaly discussed above.

Table 3. INFLUENCE OF MESSAGE INTERARRIVAL TIME ON SYSTEM PERFORMANCE.

Parameter used :					
Mes. No.	Mes. Size	Buf. Size	Tran. Time	Retrans. Time	Data Collect. Start point
3000	5	22 mes.	24	24	500
Data obtained :					
Mes. Inter.	Buf. Block.	Capt. Time	Hold. Time	Comp. Time	
2.5	0.0151	4.9694	33.7431	38.7125	
2.4	0.0225	5.0356	33.8029	38.8385	
2.3	0.0331	5.1577	33.8276	38.9853	
2.2	0.0512	5.4028	33.8598	39.2625	
2.1	0.0762	5.7429	33.9313	39.6742	
2.0	0.1225	6.4964	34.0844	40.5808	
1.9	0.1908	7.7738	34.2248	41.9986	
1.8	0.3166	11.1101	34.5784	45.6885	
1.7	0.5252	19.7649	34.8937	54.6587	
1.6	0.7995	50.8323	35.1051	85.9374	
1.5	0.9535	146.5569	35.0122	181.5691	

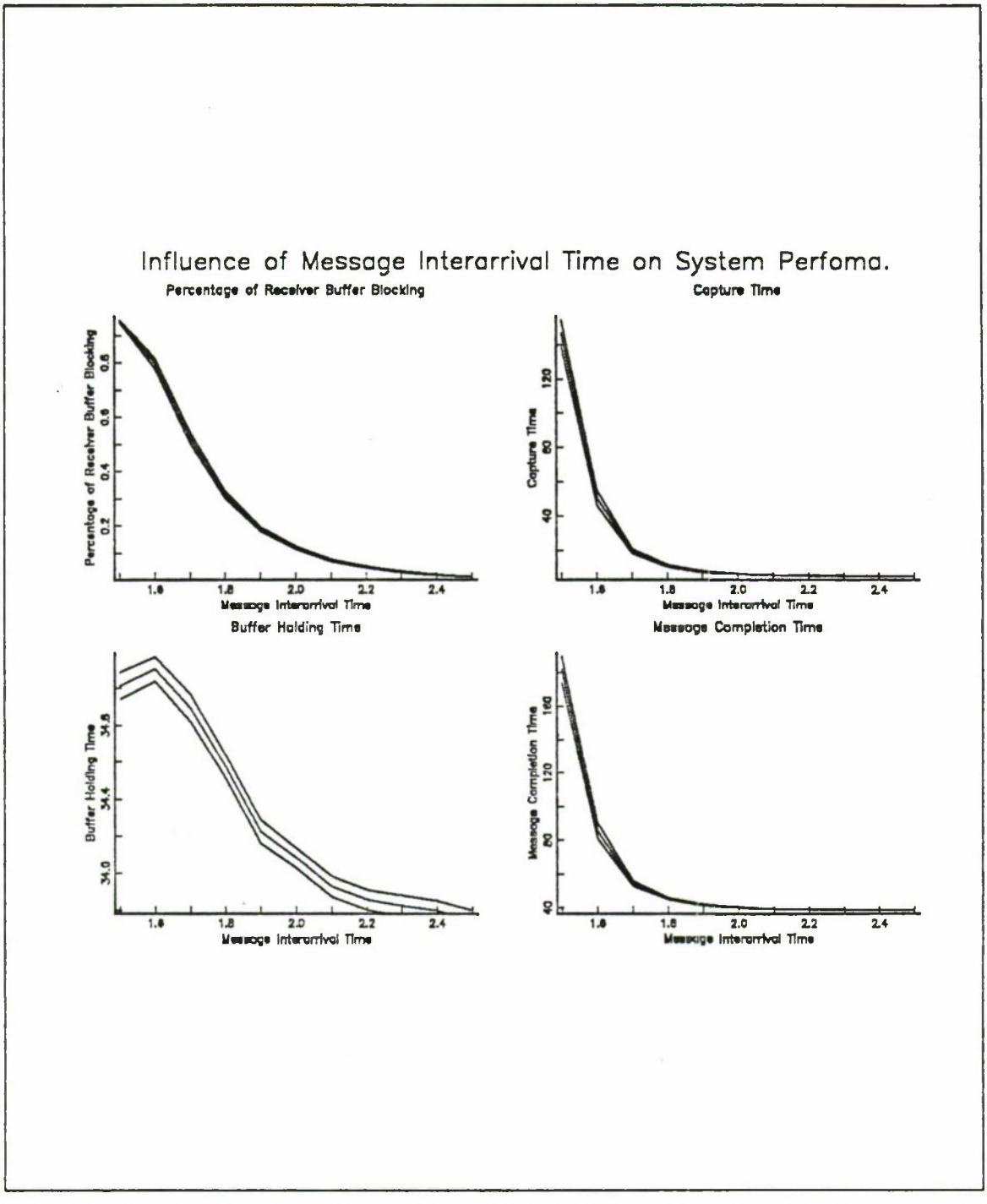

Figure 16. Influence of Message Interarrival Time on System Performance.

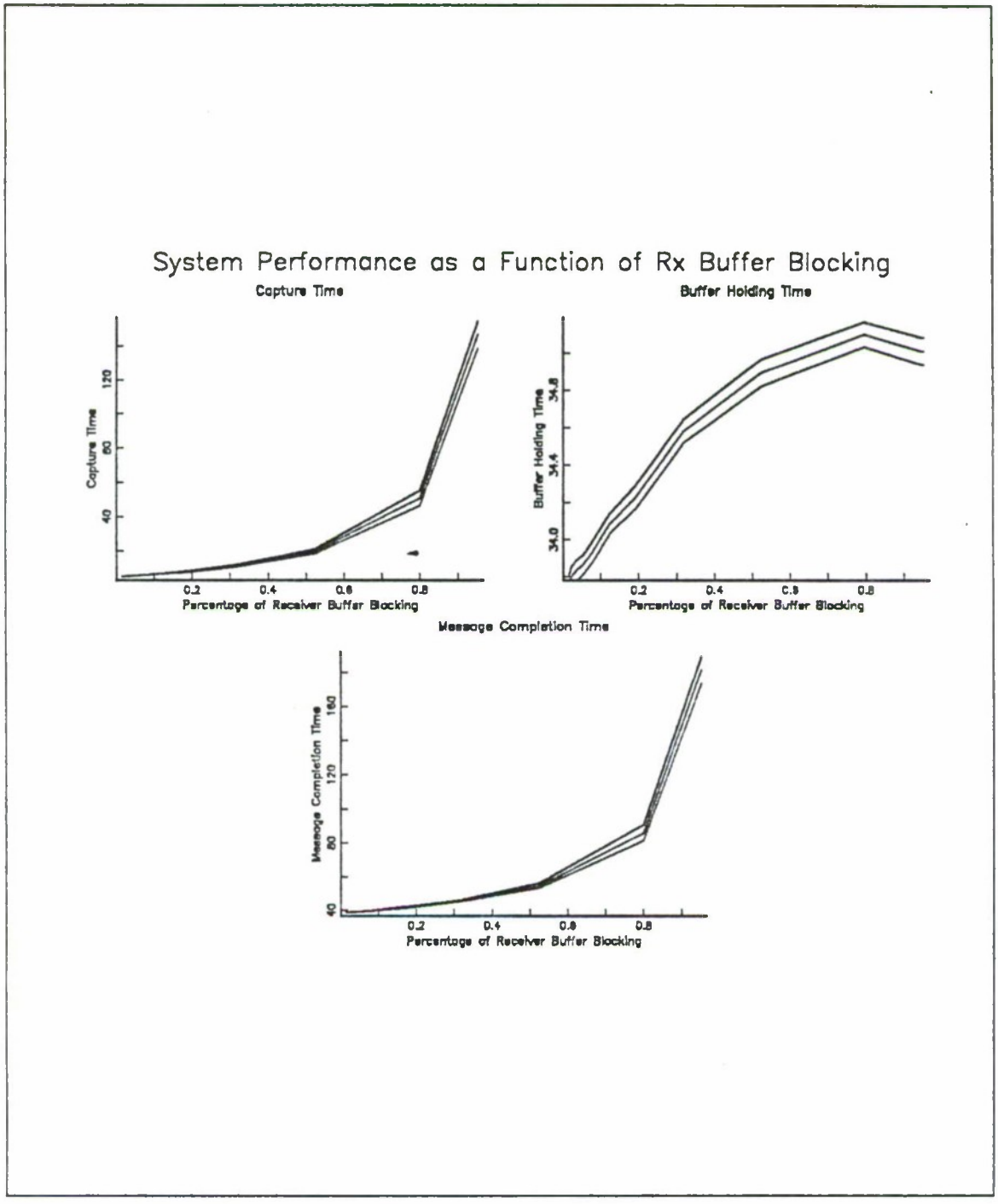

Figure 17. Influence of Message Interarrival Time on System Performance.

3. Influence of Transit Time on System Performance

Figure 18 shows that an increase in the network transit time causes a corresponding increase in receiver buffer blocking, capture time, buffer holding time and message completion time.

Figure 19 reveals that as receiver buffer blocking increases; capture time, buffer holding time and message completion time increase.

Table 4. INFLUENCE OF TRANSIT TIME ON SYSTEM PERFORMANCE.

Parameter used :					
Mes. No.	Mes. Size	Buf. Size	Mes. Inter.	Retrans. Time	Data Collect. Start point
3000	5	22 mes.	2	24	500

Data obtained :				
Tran. Time	Buf. Block.	Capt. Time	Hold. Time	Comp. Time
15	0.0081	3.0719	25.2431	28.3150
16	0.0129	3.3252	26.3330	29.6582
17	0.0171	3.5579	27.3685	30.9264
18	0.0261	3.8611	28.4134	32.2745
19	0.0333	4.1308	29.4335	33.5643
20	0.0466	4.4909	30.4046	34.8955
21	0.0569	4.8353	31.3336	36.1689
22	0.0779	5.3236	32.3013	37.6249
23	0.0978	5.8281	33.1963	39.0244
24	0.1167	6.3805	33.9908	40.3713
25	0.1427	6.9968	34.8739	41.8706

Table 5. INFLUENCE OF TRANSIT TIME ON SYSTEM PERFORMANCE (CONTINUED).

Data obtained :				
Tran. Time	Buf. Block.	Capt. Time	Hold. Time	Comp. Time
26	0.1770	7.9431	35.7405	43.6836
27	0.2084	8.8710	36.5059	45.3769
28	0.2375	9.7729	37.2318	47.0047
29	0.2825	11.2795	37.9834	49.2628
30	0.3161	12.5010	38.6789	51.1799
31	0.3656	14.3288	39.3308	53.6596
32	0.4193	16.5498	40.0080	56.5578
33	0.4448	18.0622	40.4861	58.5484
34	0.5044	21.0689	41.0359	62.1049
35	0.5495	23.7348	41.4876	65.2224
36	0.5828	26.2605	41.9135	68.1740
37	0.6251	30.0334	42.2583	72.2917
38	0.6580	32.5182	42.6657	75.1839
39	0.6966	37.5620	42.8545	80.4164
40	0.7310	42.4514	43.2239	85.6753
41	0.7642	47.2198	43.4428	90.6626
42	0.7932	52.6928	43.5963	96.2891
43	0.8194	59.6735	43.8129	103.4864
44	0.8412	64.9371	43.9716	108.9086

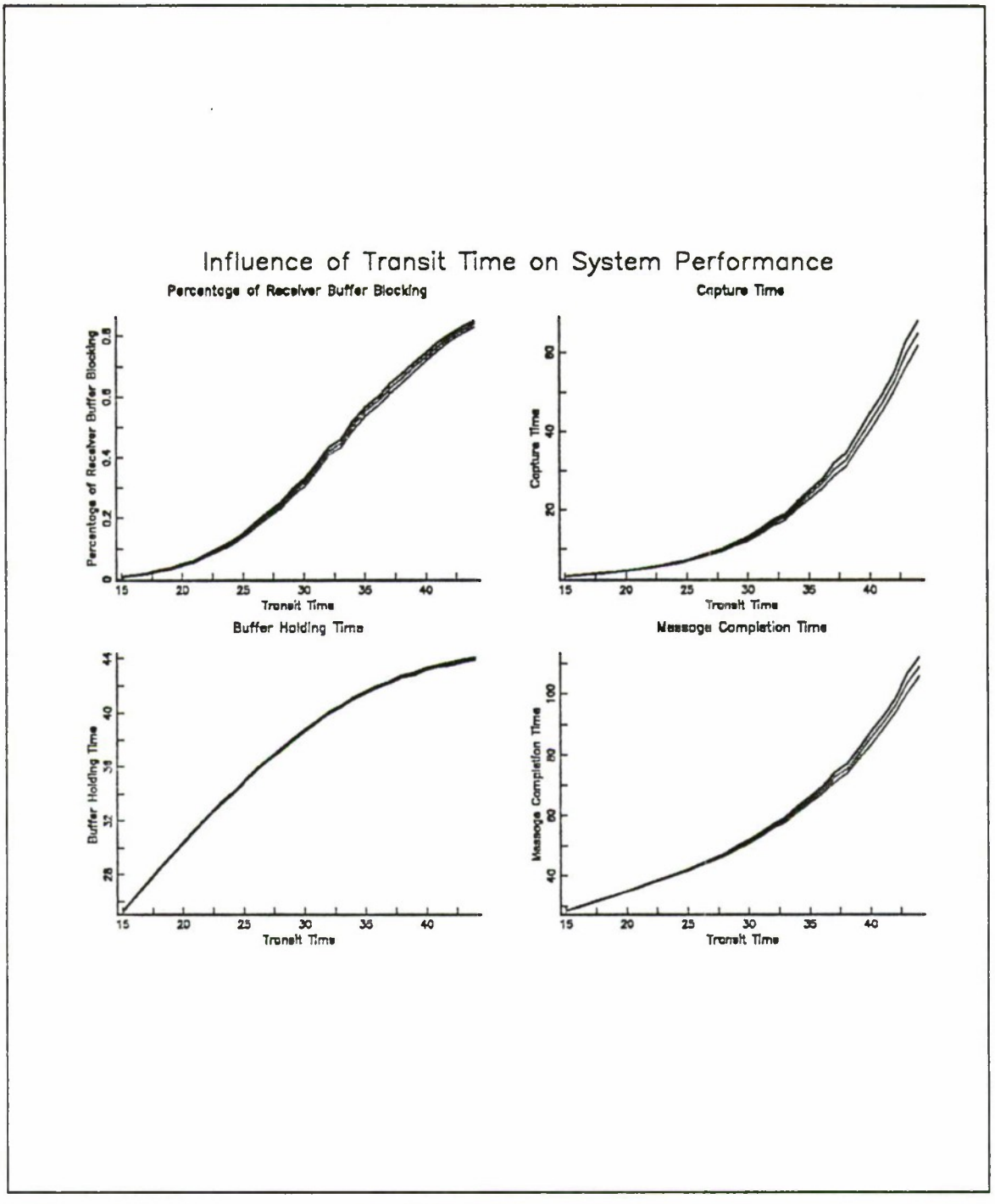

Figure 18. Influence of Transit Time on System Performance.

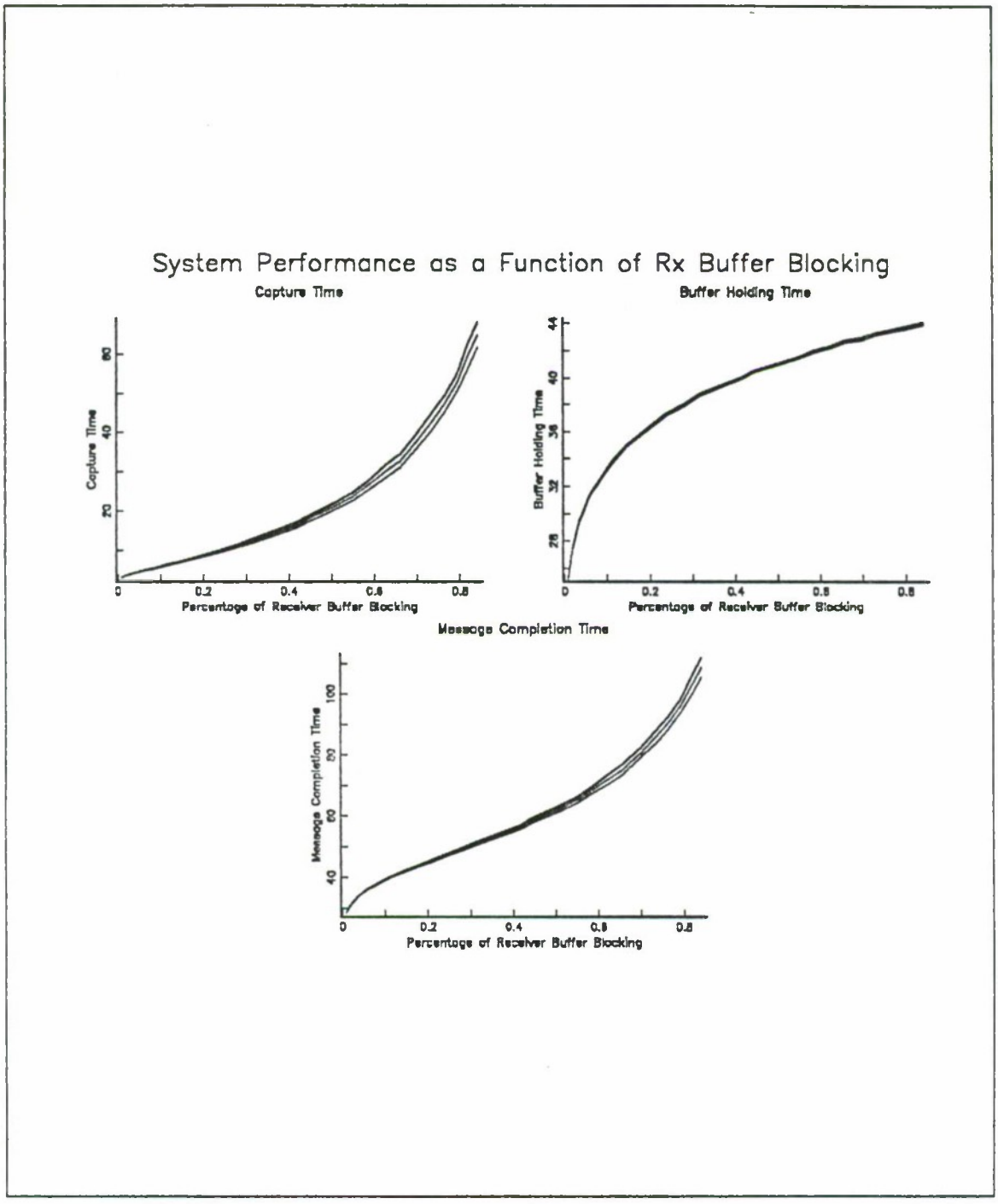
System Performance as a Function of Rx Buffer Blocking
Capture Time
Capture Time
Percentage of Receiver Buffer Blocking
Buffer Holding Time
Buffer Holding Time
Percentage of Receiver Buffer Blocking
Message Completion Time
Message Completion Time
Percentage of Receiver Buffer Blocking

Figure 19. Influence of Transit Time on System Performance.

4. Influence of Retransmission Time on System Performance

The graphs in Figure 20 indicate that an increase in the retransmission time interval causes an increase in receiver buffer blocking, capture time, buffer holding time and message completion time. Notice that when the retransmission time is approximately 30, that the message completion time takes a rapid upswing. The ratio of the mean transit time to the retransmission time is approximately 1.25 at this approximate data point. This may indicate that there may be an optimum ratio of these two parameters at which the greatest system performance may be achieved.

Figure 21 simply shows that as receiver buffer blocking increases, capture time, buffer holding time and the message completion time also increase.

Table 6. INFLUENCE OF RETRANSMISSION TIME ON SYSTEM PERFORMANCE.

Parameters used :					
Mes. No.	Mes. Size	Buf. Size	Mes. Inter.	Tran. Time	Data Collect. Start point
3000	5	22 mes.	2	24	500
Data obtained :					
Retran. Time	Buf. Block.	Capt. Time	Hold. Time	Comp. Time	
16	0.0214	4.9394	28.2922	33.2316	
17	0.0306	5.0471	29.1084	34.1555	
18	0.0366	5.1130	29.8507	34.9637	
19	0.0470	5.2658	30.6045	35.8703	
20	0.0555	5.3661	31.2504	36.6165	
21	0.0697	5.6000	32.0058	37.6059	
22	0.0818	5.7733	32.6483	38.4216	
23	0.0990	6.0405	33.3098	39.3503	
24	0.1225	6.4964	34.0844	40.5808	
25	0.1436	6.8854	34.7430	41.6284	
26	0.1734	7.5652	35.4931	43.0582	
27	0.2060	8.4213	36.2236	44.6449	
28	0.2517	9.8460	37.0024	46.8484	
29	0.2949	11.3792	37.8304	49.2096	
30	0.3543	14.6999	38.6960	53.3959	
31	0.4148	17.9702	39.6931	57.6633	
32	0.5354	29.2926	41.0862	70.3788	
33	0.6785	51.2290	42.6788	93.9078	
34	0.7842	82.1526	44.3559	126.5085	
35	0.8618	125.7724	46.1042	171.8765	

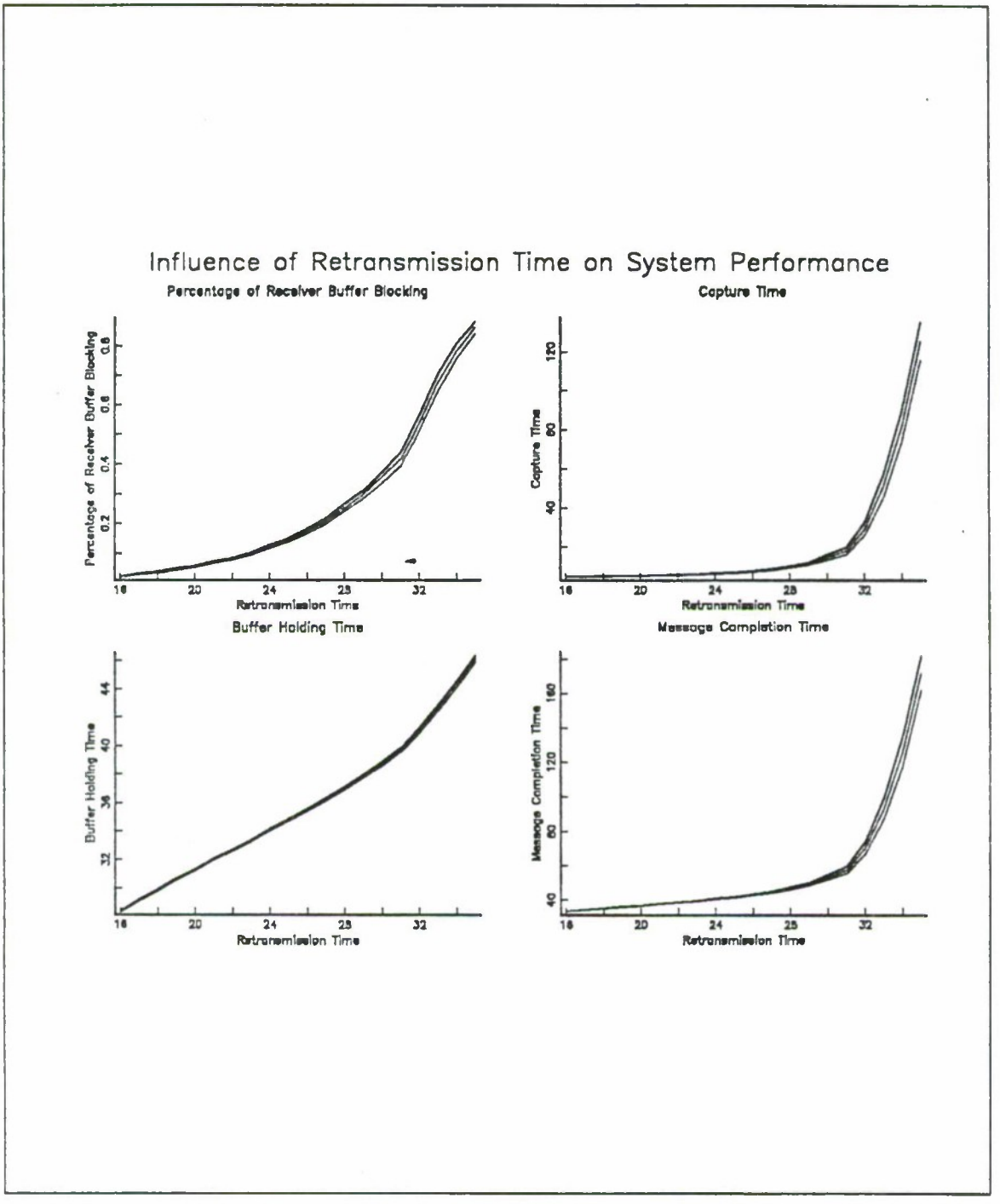

Figure 20. Influence of Retransmission Time on System Performance.

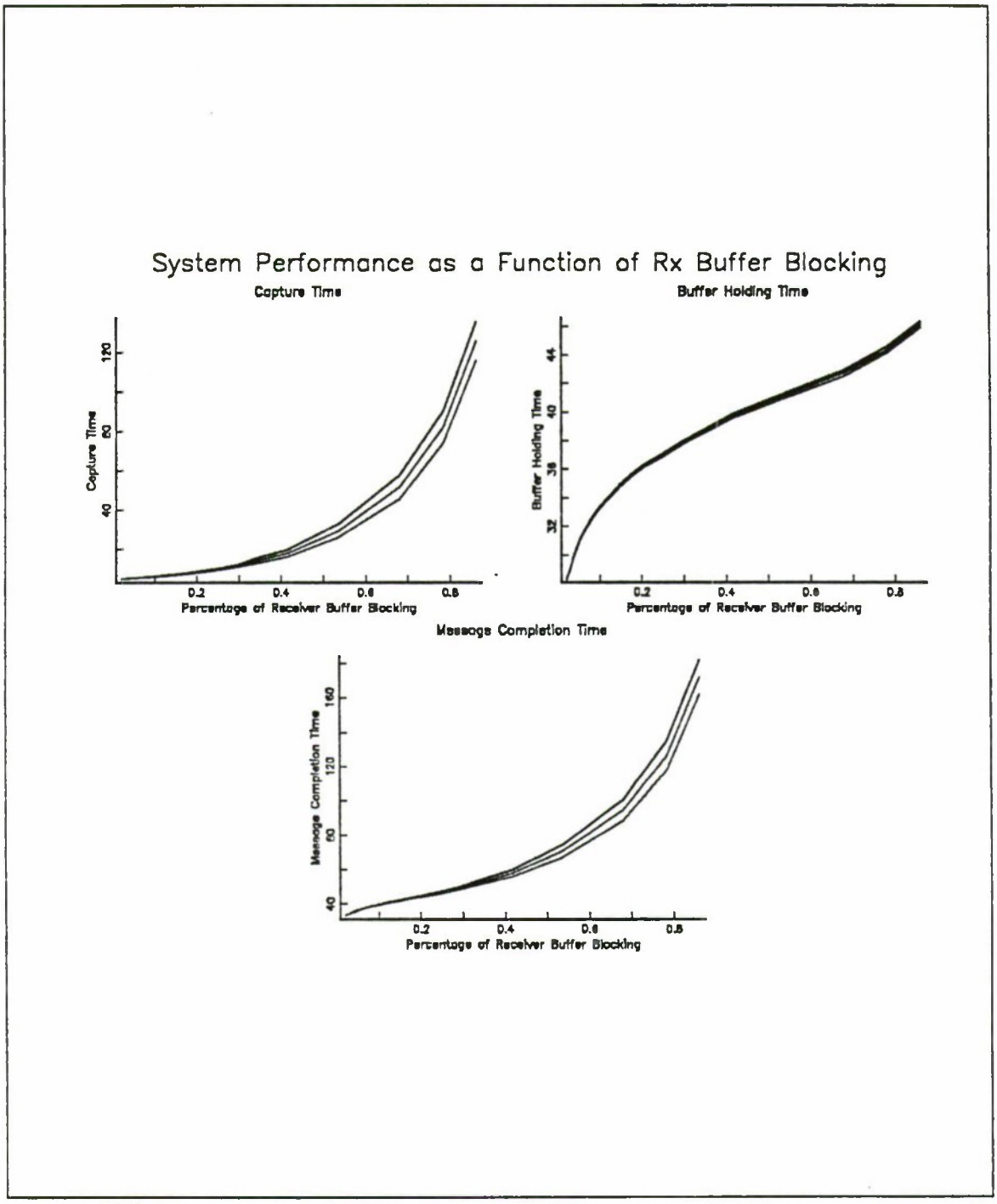

Figure 21. Influence of Retransmission Time on System Performance.

5. Influence of Receiver Buffer Size on System Performance

Figure 22 clearly demonstrates that an increase in receiver buffer size causes a marked decrease in the percentage of receiver buffer blocking. Furthermore, note that although there is a rapid decrease in both capture time and message completion time, buffer holding time is not effected to such a degree.

Figure 23 further illustrates that as the percentage of receiver buffer blocking increases, both capture time and the message completion time increase sharply and that buffer holding time increases much more slowly.

Table 7. INFLUENCE OF RECEIVER BUFFER SIZE ON SYSTEM PERFORMANCE.

Parameters used :					
Mes. No.	Mes. Size	Mes. Inter.	Tran. Time	Retrans. Time	Data Collect. Start point
3000	5	2	24	24	500
Data obtained :					
Buf. Size (mes.)	Buf. Block.	Capt. Time	Hold. Time	Comp. Time	
26	0.0154	4.9647	33.7007	38.6654	
25	0.0263	5.0862	33.6983	38.7845	
24	0.0454	5.3089	33.8419	39.1508	
23	0.0736	5.6818	33.8869	39.5686	
22	0.1225	6.4964	34.0844	40.5808	
21	0.1933	7.8266	34.2721	42.0986	
20	0.3155	11.2737	34.5401	45.8138	
19	0.5074	20.3565	34.9467	55.3032	
18	0.7565	46.5814	35.2904	81.8718	
17	0.9323	135.2836	36.0625	171.3461	

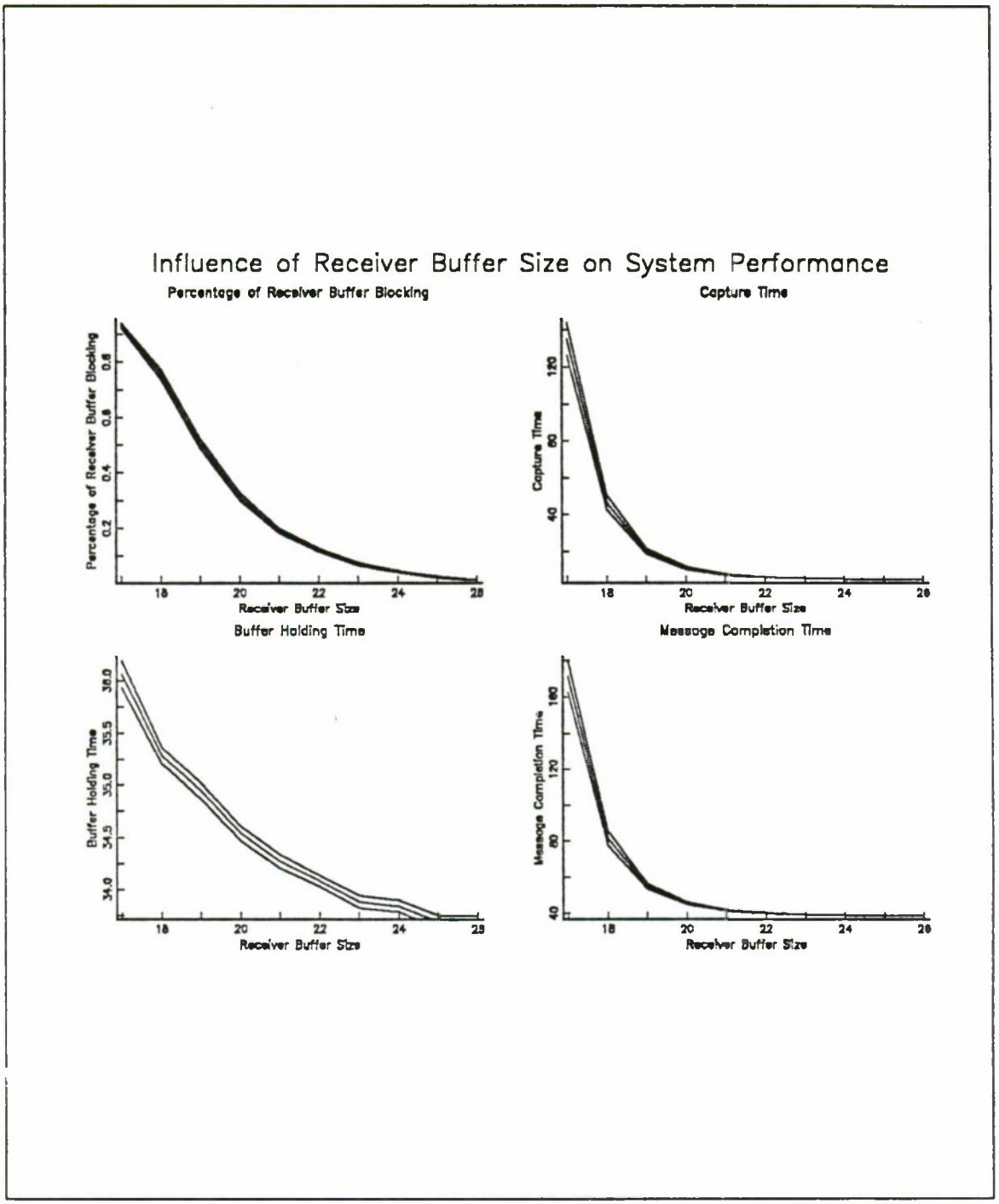

Figure 22. Influence of Receiver Buffer Size on System Performance.

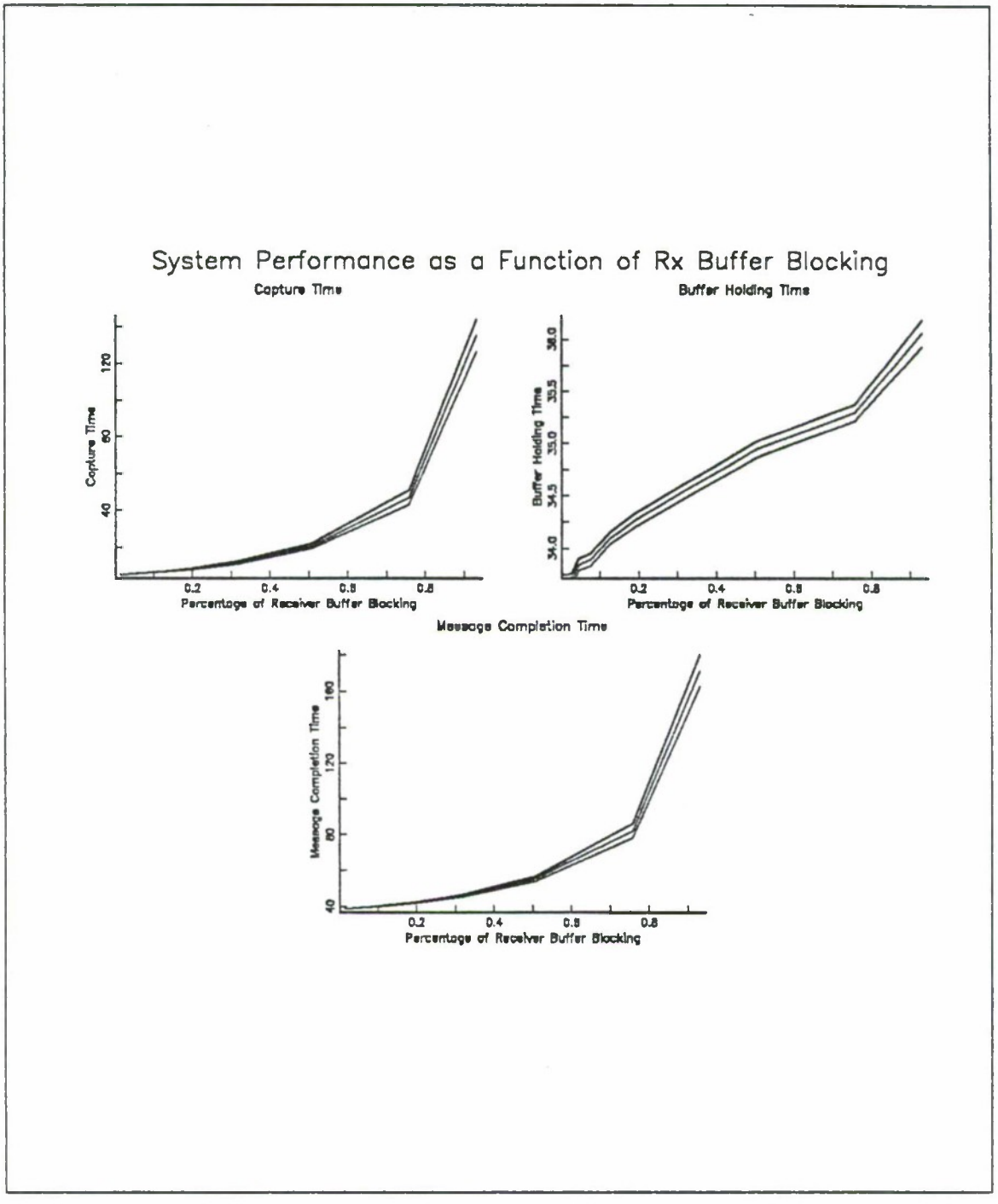

Figure 23. Influence of Receiver Buffer Size on System Performance.

6. Influence of Message Size on System Performance (Fixed Buffer Size of 198 Packets)

This data set assumes a fixed buffer size of 198 packets and allows the size of message to vary from 2 to 9 packets. In other words, the number of messages the buffer can hold varies between 22 and 99.

Figure 24 shows that an increase in message size has no influence on receiver buffer blocking when message size is between 2 and 8 packets, but still causes a slight increase in both buffer holding time and message completion time. A local minimum point appears in the capture time when the message size is 7 packets. The sudden rise in the plots are probably due to the fact that, since we are using a fixed buffer size, a point is reached when the buffer no longer has space to accomodate multiple messages.

Most of the values for receiver buffer blocking are zero and, as a result, the graphs for system performance as a function of receiver buffer blocking have been omitted.

Table 8. INFLUENCE OF MESSAGE SIZE ON SYSTEM PERFORMANCE (FIXED BUFFER SIZE OF 198 PACKETS).

Parameter used :					
Mes. No.	Buf. Size	Mes. Inter.	Tran. Time	Retrans. Time	Data Collect. Start point
3000	198 packets	2	24	24	500

Data obtained :				
Mes. Size	Buf. Block.	Capt. Time	Hold. Time	Comp. Time
2	0.0000	11.2057	16.4307	27.6363
3	0.0000	7.8091	24.7499	32.5590
4	0.0000	5.9829	29.9715	35.9544
5	0.0000	4.8147	33.6360	38.4507
6	0.0010	4.0487	36.5109	40.5596
7	0.0000	3.7249	38.8913	42.6162
8	0.0000	8.7090	41.7354	50.4445
9	0.8496	67.8963	45.5294	113.4257

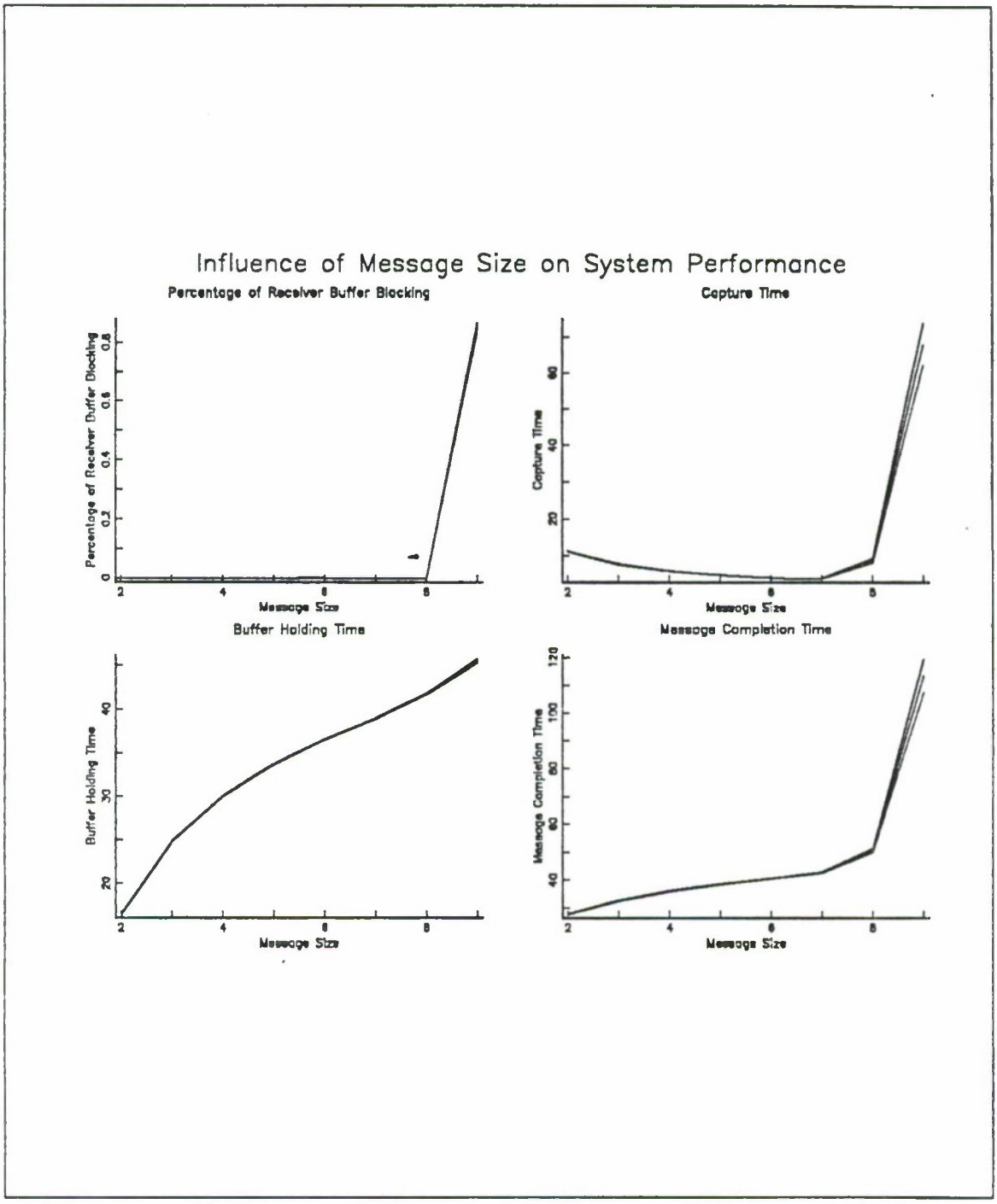

Figure 24. Influence of Message Size on System Performance (Fixed Buffer Size of 198 Packets).

7. Influence of Message Size on System Performance (Fixed Buffer Size of 22 Messages)

Unlike the previous data set which assumed a fixed buffer size of 198 packets, this data set fixes the number of message that can fit into the buffer at 22. That is, the buffer size varies to accommodates a total of 22 messages regardless of message size.

Figure 25 shows that an increase in message size causes an increase in receiver buffer blocking, buffer holding time and message completion time. A local minimum point appears in capture time when the message size is 4 packets. This may very well indicate that there is an optimal relationship between message size and the retransmission rate.

Figure 26 indicates that as the percentage of the receiver buffer blocking increases, buffer holding time and message completion time also increase. However, once again, a local minimum point appears in capture time when receiver buffer blocking is approximately 0.036.

Table 9. INFLUENCE OF MESSAGE SIZE ON SYSTEM PERFORMANCE (FIXED BUFFER SIZE OF 22 MESSAGES).

Parameter used :					
Mes. No.	Buf. Size	Mes. Inter.	Tran. Time	Retrans. Time	Data Collect. Start point
3000	22 mes.	2	24	24	500

Data obtained :				
Mes. Size	Buf. Block.	Capt. Time	Hold. Time	Comp. Time
2	0.0000	11.2056	16.4328	27.6384
3	0.0059	7.9086	24.7330	32.6415
4	0.0367	6.4152	30.0541	36.4693
5	0.1225	6.4964	34.0844	40.5808
6	0.2628	8.4361	37.2830	45.7191
7	0.4670	14.9177	40.1167	55.0344
8	0.6821	30.9090	42.5643	73.4733
9	0.8496	67.8963	45.5294	113.4257

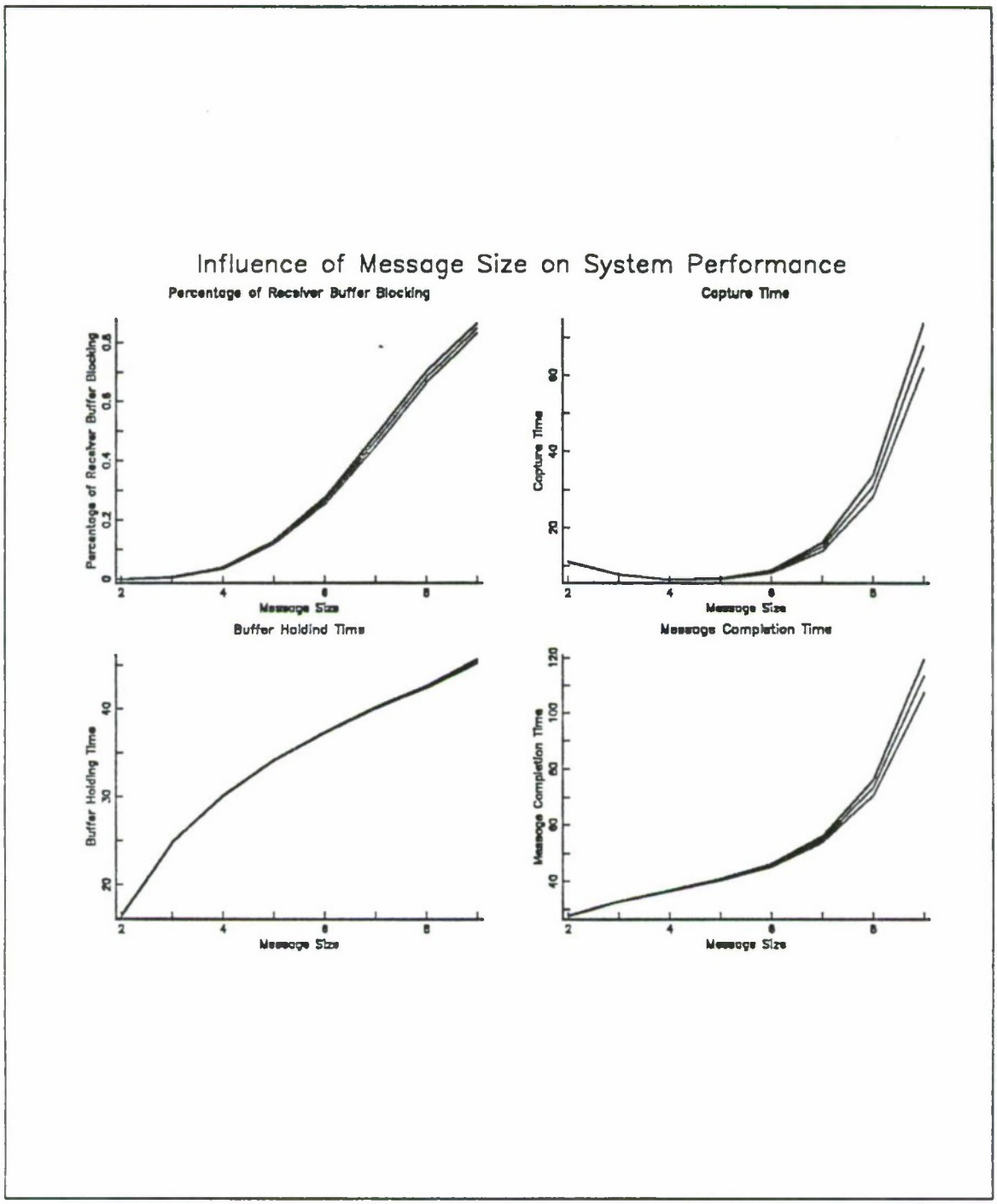

Figure 25. Influence of Message Size on System Performance (Fixed Buffer Size of 22 Messages).

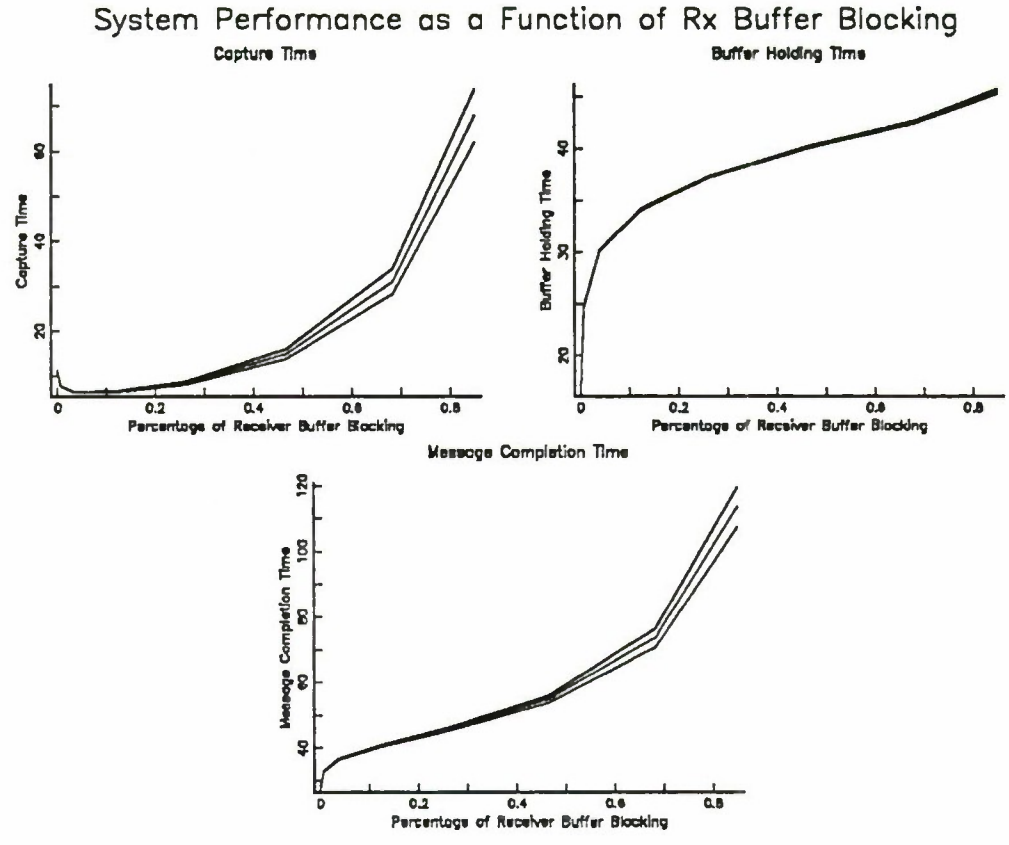
System Performance as a Function of Rx Buffer Blocking
Capture Time
Capture Time
Percentage of Receiver Buffer Blocking
Buffer Holding Time
Buffer Holding Time
Percentage of Receiver Buffer Blocking
Message Completion Time
Message Completion Time
Percentage of Receiver Buffer Blocking

Figure 26. Influence of Message Size on System Performance (Fixed Buffer Size of 22 Messages).

V. CONCLUSIONS AND RECOMMENDATIONS

A. CONCLUSIONS

The composite graphs in Figure 27 and Figure 29 show that a change in any single parameter causes a noticeable change in capture time and, thus, message completion time. Figure 28 further reveals, that the most pronounced effects on buffer holding time are caused by changes in message size, retransmission time and mean transit time. Figure 29 clearly indicates that the most significant changes in message completion times are achieved through adjustment of the buffer size and the retransmission rate (this is also consistent with the results shown in Figure 27).

From the data one might conclude that a change in the mean network transit time has little influence on overall system performance when compared to buffer size and retransmission rate. If we are concerned with only a single source of messages arriving at a single receiver this may be a valid conclusion. However, for a system with multiple message sources (transmitters) this most likely is not valid since there is probably a cumulative effect on the mean transit time by these additional sources.

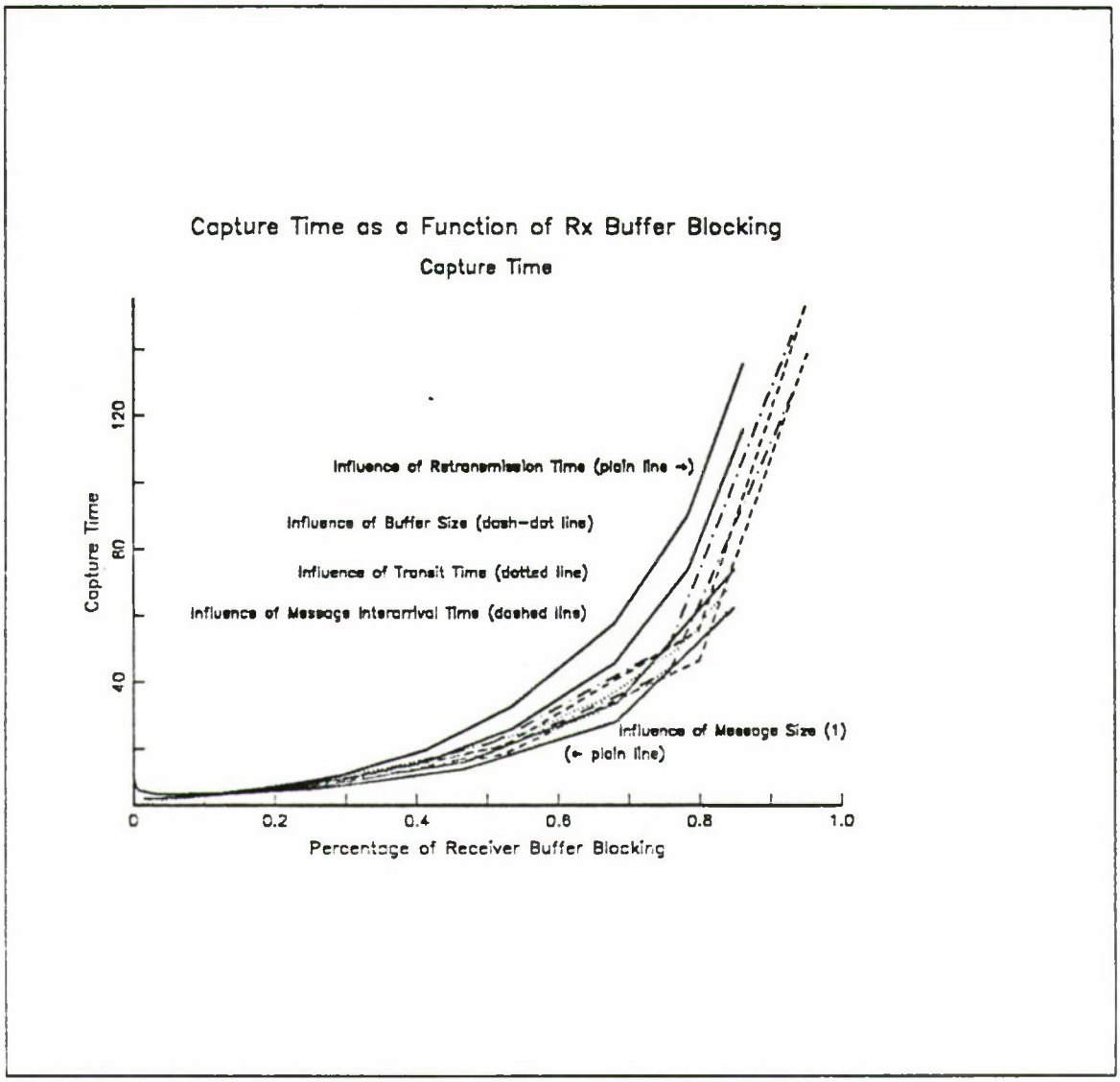

Figure 27. Capture Time as a Function of Receiver Buffer Blocking.

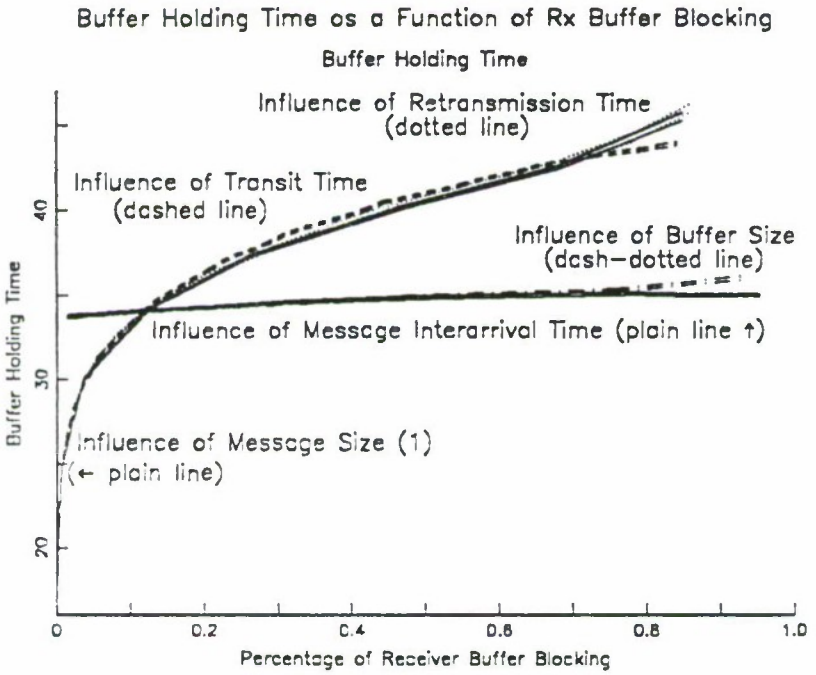

Figure 28. Buffer Holding Time as a Function of Receiver Buffer Blocking.

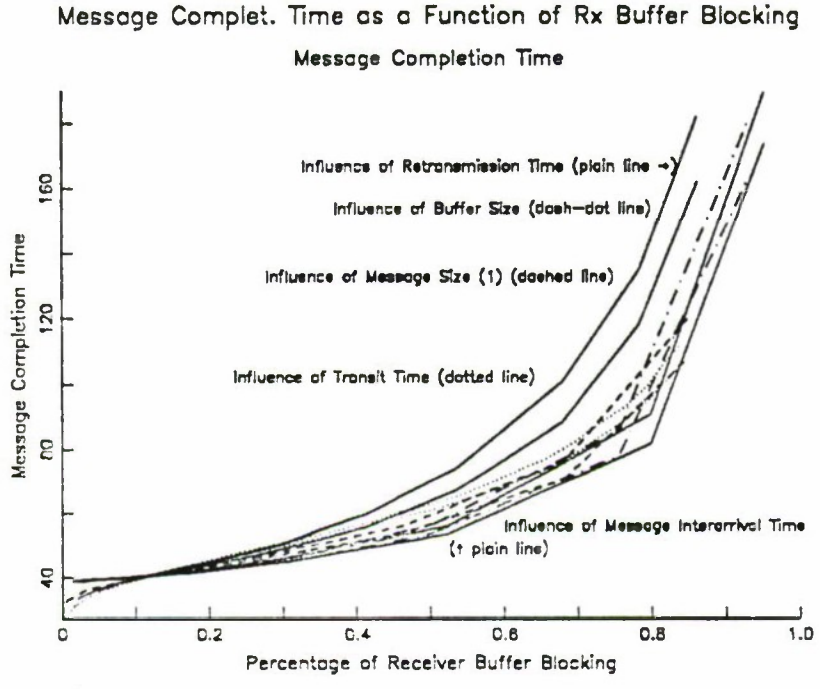

Figure 29. Message Completion Time as a Function of Receiver Buffer Blocking .

B. RECOMMENDATIONS

This simulation was run with only a narrow range of values and by only varying one parameter at a time. Additional insight into system performance might be gained by adjusting multiple parameters to determine if there is any optimal combination of values.

A model utilizing a single transmitter and receiver is not a reasonable approximation to actual packet switching networks which, generally, contain multiple transmitting stations (sources) and receivers (sinks). An effort should be made to develop a model which combines the local effects of all sources and sinks into a single transit function. This might be accomplished by using some form of back propagation as a feedback loop into the model.

In order to overcome the severe memory restrictions encountered in this simulation, selection of a language which permits dynamic memory allocation should be attempted. A language such as SIMULA II or C++ would probably be better suited for this particular simulation.

APPENDIX A. PROGRAM LISTING

```
*//SH17422J JOB (2271,9999),'SHIH',CLASS=J
*//*************************************
*//*     CLASS=A     5 SEC.
*//*           B    30 SEC.
*//*           C     3 MIN.
*//*           G    15 MIN
*//*           J    60 MIN
*//*MAIN  CARDS=(100)
*// EXEC FORTVCLG,PARM.FORT='OPT(3)',REGION.FORT=3000K,PARM.LKED='MAP',
*// REGION.GO=6000K
*//FORT.SYSPRINT DD DUMMY
*//FORT.SYSIN DD *
*****************************************************************************************
*Comment Meaning
*D1    obtain 'step of collecting data(1).
*inst  obtain 'transit state analysis of simulation.
*****************************************************************************************
* VARIABLE
*Y  ALPHSD   SEED FOR EXPONENTIAL GENERATOR 'GGEXN' TO GENERATE
*Y           INTERARRIVAL TIMES FOR MESSAGES.
*Y  BUFINI   THE INITIAL SIZE OF RECEIVER BUFFER (UNIT=MESSAGE).
*Y  BUFROM   THE MAXIMUM ROOM FOR PACKETS AT THE RECEIVER.
*Y  BUFSUB   THE SUBTRACTING VALUE OF RECEIVER BUFFER SIZE (UNIT=MESSAGE).
*Y  BUFUIT   THE MAXIMUM CURRENT SIZE OF RECEIVER BUFFER (UNIT=MESSAGE).
*Y  COLLET   ARRIVAL TIME AT THE RECEIVER FOR EACH PACKET.
*Y  COMPLT   HOLDING TIME FOR EACH MESSAGE.
*Y  FIXTIM   DETAIL TO PRINT STATUS (WHEN 'TOTMIN' GREATER THAN THIS
*Y           VALUE).
*Y  IDX      THE NUMBER OF 'ROWS' USED BY EACH MESSAGE FOR STORING
*Y           USABLE DATA.
*Y  IDXFLG   TRANSMITTING STATUS - 0 =  INITIAL TRANSMISSION.
*Y                                 1 =  RETRANSMISSION.
*Y  IDXIDX   THE ORDER FOR RETRANSMISSION.
*Y  JP       MAXIMUM MESSAGE SIZE.
*Y  JPT      CURRENT MESSAGE SIZE.
*Y  JPINI    INITIAL VALUE OF MESSAGE SIZE.
*Y  LAMDSD   SEED FOR EXPONENTIAL GENERATOR 'GGEXN' TO GENERATE TRANSIT
*Y           TIMES FOR EACH PACKET.
*Y  LN       LINE NUMBER USED IN DATA LISTING.
*Y  MAXMAX   TIME THAT LAST PACKET OF EACH MESSAGE LEAVES THE NETWORK.
*Y  MESAGE   START TIME FOR MESSAGE TRANSMISSION.
*Y  MESEXP   INTERARRIVAL TIME BETWEEN MESSAGES.
*Y  MESFLG   MESSAGE STAUS -  0 = HAVE STARTED TRANSMITTING.
*Y                           1 = HAVE RESERVED ROOM AT THE RECEIVER.
*Y                           2 = HAVE COMPLETED RECEIVING.
*Y                           3 = NO PACKETS IN THE NETWORK.
*Y  MESADD   MESSAGE SIZE INCREMENT.
*Y  MESINI   INITIAL MESSAGE SIZE.
*Y  MESMAX   TIME AT  WHICH COMPLETING PACKET ARRIVED.
*Y  MESMIN   TIME OF NEXT EVENT AT THE RECEIVER FOR EACH MESSAGE.
*Y           (BEFORE FINAL DATA COLLECTION)
```

```
*Y  MESMIN  TIME AT WHICH PACKET CAPTURED BUFFER.
*Y          (DURING FINAL DATA COLLECTION)
*Y  MESNO   THE STOPPING CRITERIA.
*Y  MESNON  THE CURRENT STOPPING POINT.
*Y  PACFLG  PACKET STATUS - 1 = KEEP DATA.
*Y                         2 = DISCARD DATA.
*Y  PACKET  TIME BETWEEN TRANSMISSION AND RECEIPT.
*Y  PACMIN  TIME OF ARRIVAL FOR FIRST PACKET AMONGST DUPLICATES.
*Y  RESERT  HOLDING TIME OF EACH MESSAGE.
*Y  RETTIM  NEXT RETRANSMISSION TIME FOR EACH MESSAGE.
*Y  RSIDX   NUMBER OF ATTEMPTS MADE BEFORE A MESSAGE COULD RESERVE
*Y          THE BUFFER.
*************************************************************************
      PROGRAM SH1519

      INTEGER JP,MESNO,IP,BUFROM,BUFUIT,JPT,LN,BUFFIX
      INTEGER MESINI,MESADD,MESNON
      INTEGER JPINI
      PARAMETER(IP=30)
      PARAMETER(MESINI=3750,MESADD=100,MESNO=3750)
      PARAMETER(JPINI=5,JP=5)
      INTEGER BUFINI,BUFSUB,BUFEND
      PARAMETER(BUFFIX=110)
      PARAMETER(BUFINI=22,BUFSUB=1,BUFEND=22)
      REAL PACMIN(JP,MESNO)
      REAL PACKET(1:MESNO)
      REAL COLLET(0:IP,1:JP,MESNO)
      REAL MESAGE(0:(MESNO+1))
      REAL MESEXP(MESNO)
      INTEGER MESFLG(MESNO),PACFLG(0:IP,1:JP,MESNO)
      INTEGER IDX(MESNO),IDXIDX(MESNO),RSIDX(MESNO)
      INTEGER IDXFLG(MESNO)
      REAL MESMAX(MESNO),MESMIN(MESNO),MAXMAX(MESNO)
      REAL RETTIM(MESNO)
      REAL*8 ALPHSD,LAMDSD
      INTEGER FIXTIM,TOTMIN
      PARAMETER(TOTMIN=7500,FIXTIM=999990)

 9    FORMAT('  LN  ',' M.N ',' P.N ',' B.C ','  M.M    ',
     C'  P.M    ','  DEL    ')
 12   FORMAT('  LN  ',' T.TRAN  ',' N.TRAN   ',' RE.TRAN ',
     C' ATTRITI  ','   P.REC   ','  M.REC  ',' OUT.SY  ','   RES')
 13   FORMAT(' AVER ',' T.TRAN  ',' N.TRAN   ',' RE.TRAN ',
     C'  ATTRITI ','   P.REC   ','  M.REC  ',' OUT.SY  ','   RES')
 14   FORMAT('  LN  ','  AVG.ATT ',' MISS.P ',
     C' REC.BK ','  CAP.T   ','  HOLD.T  ','  COMP.T  ')
 15   FORMAT(' AVER ','  AVG.ATT ',' MISS.P ',
     C' REC.BK ','  CAP.T   ','  HOLD.T  ','  COMP.T  ')
 16   FORMAT('  LN  ',' IP ','  TSEND   ',
     C'  NSEND   ','  P.MIS   ',' T.RIDX ','OUTPAC ')
 17   FORMAT('  LN  ','   M(INI) ','     TOTMIN  ',
     C'  ARR.M ',' RL.AR ','  RL.RE ',' C.P.U ')
 18   FORMAT('  LN  ','    REC.O    ','CAPP.AP ',
     C'HOLD.AP ')
 21   FORMAT('*************************************************************************')
 22   FORMAT(' AVER ','  C.P.U   ',' TIME   ',' ARRMES ',' REAL.AR',
```

```
     C' REAL.RE  ',' CAP.P.P ',' HOL.P',' REP')
 23   FORMAT('  LN  ',' CAP ',' HOLD ',' MIDX ',' RIDX ',
     C' MFLG ')
 31   FORMAT('  LN  ','ARRIVING',',      ',' CAP  ',',       ',
     C'       ',' HOL  ',',      ',',      ',' COM  ')
 32   FORMAT('  LN  ',',       ','ARRIVING',',       ',',       ',
     C'REC.BK ')

      WRITE(9,21)
*D1       12,14,16,17,18
*D1   WRITE(12,21)
      WRITE(13,21)
*D1   WRITE(14,21)
      WRITE(15,21)
*D1   WRITE(16,21)
*D1   WRITE(17,21)
*D1   WRITE(18,21)
      WRITE(22,21)

*INST  BEGIN
*     WRITE(31,21)
*     WRITE(32,21)
* INST END

      WRITE(9,9)
*D1   WRITE(12,12)
      WRITE(13,13)
*D1   WRITE(14,14)
      WRITE(15,15)
*D1   WRITE(16,16)
*D1   WRITE(17,17)
*D1   WRITE(18,18)
      WRITE(22,22)

*INST  BEGIN
*     WRITE(31,31)
*     WRITE(32,32)
* INST END

      WRITE(9,21)
*D1   WRITE(12,21)
      WRITE(13,21)
*D1   WRITE(14,21)
      WRITE(15,21)
*D1   WRITE(16,21)
*D1   WRITE(17,21)
*D1   WRITE(18,21)
      WRITE(22,21)

*INST  BEGIN
*     WRITE(31,21)
*     WRITE(32,21)
* INST END


      ALPHSD = 11111.D0
```

```
      LAMDSD=55555.D0

      BUFUIT = BUFINI + BUFSUB
  102 BUFUIT = BUFUIT - BUFSUB

      MESNON = MESINI - MESADD
  103 MESNON = MESNON + MESADD

      JPT = JPINI
  104 BUFROM=JPT*BUFUIT
*104  BUFROM=BUFFIX
      LN=JPT*10000+BUFUIT*100

          CALL   SIMULA (JPT,MESNON,IP,PACKET,PACMIN,
     CCOLLET,MESEXP,MESAGE,MESFLG,PACFLG,IDX,IDXIDX,RSIDX,IDXFLG,
     CMESMAX,MESMIN,MAXMAX,RETTIM,BUFROM,LN,FIXTIM,
     CALPHSD,LAMDSD)

           IF(JPT.EQ.JP) GO TO  107
           JPT = JPT + 1
           GO TO 104

  107      IF(MESNON.EQ.MESNO) GO TO 108
           GO TO 103

  108      IF(BUFUIT.EQ.BUFEND) GO TO 109
           GO TO 102

  109 END

      SUBROUTINE SIMULA (JP,MESNO,IP,PACKET,PACMIN,
     CCOLLET,MESEXP,MESAGE,MESFLG,PACFLG,IDX,IDXIDX,RSIDX,IDXFLG,
     CMESMAX,MESMIN,MAXMAX,RETTIM,BUFROM,LN,FIXTIM,
     CALPHSD,LAMDSD)

*************************************************************************************************
* VARIABLE
*Y  ALPHSD  SEED USED BY EXPONENTIAL GENERATOR 'GGEXN' TO GENERATE
*Y          INTERARRIVAL TIMES.
*Y  ARRIVP  CONSTANT (-5) USED FOR FINDING THE MAXIMUM VALUE OF 'MAXMAX'
*Y          'MESMAX'.
*Y  ARRMES  SEQUENCE NUMBER OF MESSAGE ARRIVING AT THE TRANSMITTER.
*Y  ARRNO   SEQUENCE NUMBER OF MESSAGES WHEN CERTAIN MESSAGE COMPLETES
*Y          RECEIVING (FOR TRANSIENT STATE).
*Y  ARRSTP  STOPPING CRITERIA (MAX MESSAGE COUNT).
*Y  BUFAVA  THE AVAILABLE ROOM FOR PACKETS AT THE RECEIVER.
*Y  BUFCOL  THE TOTAL AMOUNT OF TIME THAT RECEIVER BUFFER WAS BLOCKED
*Y          FOR TRANSIENT ANALYSIS.
*Y  BUFROM  THE MAXIMUM ROOM FOR PACKETS AT THE RECEIVER.
*Y  BUFTIM  THE TOTAL TIME WHEN RECEIVER BUFFER WAS BLOCKED.
*Y  BUFUIT  THE MAXIMUM ROOM FOR MESSAGES AT THE RECEIVER.
*Y  COLLET  ARRIVAL TIME AT THE RECEIVER FOR EACH PACKET.
*Y  COMPLT  HOLDING TIME FOR EACH MESSAGE.
*Y  DELTAP  RETRANSMIT TIME INTERVAL.
*Y  FIXTIM  DETAIL PRINT STATUS (WHEN 'TOTMIN' GREATER THAN THIS VALUE).
*Y  IDX     THE NUMBER OF 'ROWS' USED BY EACH MESSAGE FOR STORING
```

```
*Y           USABLE DATA.
*Y   IDXF    THE MAXIMUM "ROWS" OF USED MEMORY WHICH CAN BE DISCARDED.
*Y   IDXFLG  TRANSMITTING STATUS - 0 =  INITIAL TRANSMISSION.
*Y                                 1 =  RETANSMISSION.
*Y   IDXIDX  SEQUENCE NUMBER FOR RETRANSMISSION.
*Y   IIIDX   SEQUENCE NUMBER OF "ROW" USED IN MEMORY FOR PACKET ARRIVING
*Y           AT THE RECEIVER.
*Y   INFINI  CONSTANT (999777) USED FOR FINDIND MINIMUM VALUE OF
*Y           'RETTIM','PACMIN','MESMIN'.
*Y   INFITM  CONSTANT (911111) USED FOR FINDING THE MINIMUM VALUE
*Y           OF 'TOTMIN'.
*Y   INIBUF  THE TOTAL TIME WHEN RECEIVER BUFFER WAS BLOCKED
*Y           DURING THE INITIAL STATE.
*Y   INICLS  TOTAL NUMBER OF PACKETS MISSED AT THE RECEIVER
*Y           (DUE TO BOTH FULL RECEIVER BUFFER AND COLLISONS)
*Y           DURING THE INITIAL STATE.
*Y   INIOTP  NUMBER OF PACKET TO ARRIVE AT THE RECEIVER (PACKETS
*Y           MISSED DUE TO COLLISON OR FULL RECEIVER BUFFER ARE
*Y           INCLUDED) DURING INITIAL STATE.
*Y   INIPMS  TOTAL PACKETS MISSED AT THE RECEIVER (DUE TO BOTH
*Y           FULL RECEIVER BUFFER AND COLLISONS) DURING THE INITIAL STATE.
*Y   INISD   THE NUMBER OF PACKETS TRANSMITTED DURING THE INITIAL
*Y           STATE.
*Y   INITIM  TIME TO START COLLECTING DATA (INITIAL STATE).
*Y   INITNS  NUMBER OF PACKETS INITIALLY TRANSMITTED DURING
*Y           THE INITIAL STATE.
*Y   IP      THE MAXIMUM NUMBER OF 'ROWS' OF EACH MESSAGE AVAILABLE
*Y           FOR STORING USABLE DATA.
*Y   JDX     THE SEQUENCE NUMBER FOR PACKET OF THE MESSAGE
*Y           ARRIVING AT THE RECEIVER.
*Y   JP      MESSAGE SIZE.
*Y   LALA    USED MEMORY STATUS - 1 = KEEP DATA.
*Y                                2 = DISCARD DATA.
*Y   LAMDSD  SEED USED BY EXPONENTIAL GENERATOR 'GGEXN' FOR GENERATING
*Y           TRANSIT TIME.
*Y   LN      LINE NUMBER FOR DATA LISTING.
*Y   MAXMAX  TIME THAT LAST PACKET OF EACH MESSAGE LEFT THE NETWORK.
*Y   MCLDX   SEQUENCE NUMBER OF COLLISION MESSAGE.
*Y   MCLNO   TOTAL NUMBER OF COLLISION PACKETS.
*Y   MDX     MESSAGE WHICH PROGRAM IS PROCESSING.
*Y   MESAGE  START TIME FOR TRANSMITTING EACH MESSAGE.
*Y   MESEXP  INTERARRIVAL TIME BETWEEN MESSAGES AT THE TRANSMITTER.
*Y   MESFLG  MESSAGE STAUS -  0 = HAVE STARTED TRANSMITTING
*Y                               (ONLY FIT AT THE OUTPUT).
*Y                            1 = HAVE RESERVED ROOM AT THE RECEIVER.
*Y                            2 = HAVE COMPLETED RECEIVING.
*Y                            3 = NO PACKETS IN THE NETWORK.
*Y   MESINI  THE SEQUENCE NUMBER OF FIRST MESSAGE TO BE CONSIDERED
*Y           DURING THE INITIAL STATE
*Y   MESMAX  TIME AT WHICH COMPLETING PACKET ARRIVED.
*Y   MESMIN  TIME OF NEXT EVENT AT THE RECEIVER FOR EACH MESSAGE.
*Y           (BEFORE FINAL DATA COLLECTION)
*Y   MESMIN  TIME AT WHICH PACKET CAPTURED BUFFER.
*Y           (DURING FINAL DATA COLLECTION)
*Y   MESNO   THE STOPPING CRITERIA.
*Y   MISS    CONSTANT (999555) USED TO INDICATE LOST PACKET
```

```
*Y            DUE TO FULL RECEIVER BUFFER.
*Y   MMINCH   0     : TIME FOR ARRIVAL EVENT IS UNCHANGED.
*Y            MORE THAN 0 : NEED SEARCH THE EARLIEST ARRIVING EVENT.
*Y   MOVIDX   THE NUMBER OF ROWS IN MEMORY THAT MAY BE DISCARDED.
*Y   MUALPH   MEAN VALUE FOR EXPONENTIAL GENERATOR 'GGEXN' TO GENERATE
*Y            INTERARRIVAL TIMES.
*Y   MULAMD   MEAN VALUE FOR EXPONENTIAL GENERATOR 'GGEXN' TO GENERATE
*Y            TRANSIT TIME.
*Y   OUTPAC   NUMBER OF PACKETS TO ARRIVE AT THE RECEIVER (PACKET
*Y            MISSED DUE TO COLLISON OR FULL RECEIVER BUFFER ARE
*Y            INCLUDED)
*Y   PACFLG   PACKET STATUS - 1 = KEEP DATA.
*Y                            2 = DISCARD DATA.
*Y   PACKET   TIME BETWEEN TRANSMITTER AND RECEIVER.
*Y   PACMIN   TIME OF ARRIVAL FOR FIRST PACKET AMONGST DUPLICATES.
*Y            PACKETS IN DIFFERENT TRANSMITTING
*Y   PDX      THE SEQUENCE NUMBER (AFTER GENERATING EACH TIME)
*Y            OF 'PACKET' BEING USED.
*Y   PMISRA   RATIO OF THE NUMBER OF PACKET MISSED (INCLUDING COLLISONS)
*Y            TO THE NUMBER OF PACKETS ARRIVED AT THE RECEIVER (PACKETS
*Y            MISSED DUE TO COLLISON OR FULL RECEIVER BUFFER ARE INCLUDED).
*Y   PREBFT   THE TOTAL TIME RECEIVER BUFFER WAS BLOCKED
*Y            AT THE PREVIOUS STAGE (USED FOR TRANSIENT ANALYSIS).
*Y   PRERUN   SEQUENCE NUMBER OF MESSAGE AT THE FIRST POINT
*Y            IN THE SEARCH RANGE FOR NEXT ARRIVAL EVENT.
*Y   REALAR   THE TOTAL NUMBER OF MESSAGES WHICH HAVE ARRIVED AT
*Y            THE RECEIVER WHEN PROGRAM HALTS.
*Y   REALRE   THE TOTAL NUMBER OF MESSAGES WHICH HAVE RESERVED ROOM
*Y            AT RECEIVER WHEN PROGRAM HALTS.
*Y   SENDX    THE NUMBER USED TO GENERATE 'MESNO' OF 'PACKET'.
*Y   RESERT   HOLDING TIME OF EACH MESSAGE.
*Y   RETTIM   NEXT RETRANSMISSION TIME OF EACH MESSAGE.
*Y   RSIDX    NUMBER OF ATTEMPTS MADE BEFORE A MESSAGE COULD RESERVE
*Y            THE BUFFER.
*Y   TIMINT   SIMULATION ELAPSED TIME (USED FOR TRANSIENT STATE ANALYSIS).
*Y   TOTCOM   TOTAL HOLDING TIME FOR MESSAGES.
*Y   TOTMIN   TIME OF NEXT EVENT AT THE RECEIVER.
*Y   TOTRES   TOTAL TIME OF 'RESERT'.
*Y   TTCLIS   TOTAL NUMBER OF PACKETS LOST DUE TO COLLISIONS.
*Y   TTPMIS   TOTAL NUMBER OF PACKET MISSED AT THE RECEIVER
*Y            (DUE TO BOTH FULL RECEIVER BUFFER AND COLLISONS).
*Y   TTNWSD   TOTAL PACKETS TRANSMITTED AT THE FIRST TRANSMISSION.
*Y   TTRSIX   TOTAL NUMBER OF 'RSIDX'.
*Y   TTSEND   TOTAL PACKETS TRANSMITTED.
*Y   VISMES   MESSAGE COLLISON STATUS  1 = NO MESSAGE COLLISON.
*Y                             MORE THAN 1 = MESSAGE COLLISON.
*Y   VISIT    PACKET COLLISION STATUS  1 = NO PACKET COLLISON.
*Y                             MORE THAN 1 = PACKET COLLISON.
*****************************************************************************

      INTEGER JP,BUFROM,BUFAVA,ARRMES,MDX,MESNO,IP,ARRSTP
      PARAMETER(ARRSTP=3000)
      INTEGER REALAR,REALRE
      INTEGER INFINI,MISS,ARRIVP,INFITM,INFIRT,COLLIS
      PARAMETER(INFINI=999777,INFIRT=999666,MISS =999555,COLLIS=999222)
      PARAMETER(INFITM=911111)
```

```
      PARAMETER(ARRIVP = -5.)
      INTEGER VISIT
      REAL*8 ALPHSD,LAMDSD
      REAL MUALPH,MULAMD,DELTAP
      REAL MUALIN,MUALSB,MUALED
      PARAMETER(MUALIN =1.65,MUALSB=0.1,MUALED=1.65)
      REAL MULAIN,MULAAD,MULAED
      PARAMETER(MULAIN =24.,MULAAD=1.0,MULAED=24.)
      REAL DELTIN,DELTAD,DELTED
      PARAMETER(DELTIN =24.,DELTAD=1.,DELTED=24.)
      REAL PACMIN(JP,MESNO)
      REAL PACKET(1:MESNO)
      INTEGER TTPMIS,TTSEND,INIPMS
      INTEGER TTNWSD,OUTPAC,INIOTP,INITNS
      REAL COLLET(0:IP,1:JP,MESNO)
      REAL PMISRA
      REAL MESAGE(0:(MESNO+1))
      REAL MESEXP(MESNO)
      INTEGER MESFLG(MESNO),PACFLG(0:IP,1:JP,MESNO)
      INTEGER IDX(MESNO),IDXIDX(MESNO),RSIDX(MESNO)
      INTEGER MESINI
      PARAMETER(MESINI=625)
      INTEGER IDXF
      INTEGER TTRSIX
      REAL TOTMIN,INITIM
      INTEGER JDX,PDX,SENDX,LALA,MOVIDX
      INTEGER IDXFLG(MESNO)
      REAL MESMAX(MESNO),MESMIN(MESNO),MAXMAX(MESNO)
      REAL*8 TOTRES,TOTCOM
      REAL AVERES,AVECOM,COMAPP,RSPAAP

      REAL RETTIM(MESNO)
      REAL BUFTIM,TIMEBF,BUFRC,INIBUF

*INST BEGIN ,..ITIAL STATE  BFCL,221,222,223,777
*     INTEGER BFCLNP,BFCLNO,INST
*     PARAMETER(BFCLNP=3000,INST=1)
*     REAL ARRNO(0:BFCLNP),AVARRN(BFCLNP)
*     REAL UPARRN(BFCLNP),LOARRN(BFCLNP)
*     REAL*8 TOARRN(BFCLNP),SDARRN(BFCLNP)
*     REAL BUFCOL(BFCLNP),PREBFT,AVBFCL(BFCLNP)
*     REAL UPBFBK(BFCLNP),LOBFBK(BFCLNP)
*     REAL*8 TOBFCL(BFCLNP),SDBFCL(BFCLNP)
*     REAL CAPCOL(BFCLNP),PREARR,AVCAPT(BFCLNP),TIMINT
*     REAL UPCAPT(BFCLNP),LOCAPT(BFCLNP)
*     REAL*8 TOCAPT(BFCLNP),SDCAPT(BFCLNP)
*     REAL HOLCOL(BFCLNP),AVHOLT(BFCLNP)
*     REAL UPHOLT(BFCLNP),LOHOLT(BFCLNP)
*     REAL*8 TOHOLT(BFCLNP),SDHOLT(BFCLNP)
*     REAL COMCOL(BFCLNP),AVCOMT(BFCLNP)
*     REAL UPCOMT(BFCLNP),LOCOMT(BFCLNP)
*     REAL*8 TOCOMT(BFCLNP),SDCOMT(BFCLNP)
*INST END

      INTEGER TTCLIS,MCLDXN,VISMES,MCLDX,INICLS
      PARAMETER(MCLDXN=200)
```

```
      INTEGER MCLNO(MCLDXN)

      REAL AA1,AA
      REAL R1,R2,R3,R4,R5,R6,R6A,R7,R8,R9,R10

      REAL*8 TR1,TR2,TR3,TR4,TR5,TR6,TR6A,TR7,TR8,TR9
      REAL AR1,AR2,AR3,AR4,AR5,AR6,AR6A,AR7,AR8,AR9,AR10
      REAL*8 SR1,SR2,SR3,SR4,SR5,SR6,SR6A,SR7,SR8,SR9
      REAL*8 TR10,SR10
      REAL LR1,LR2,LR3,LR4,LR5,LR6,LR6A,LR7,LR8,LR9,LR10
      REAL UR1,UR2,UR3,UR4,UR5,UR6,UR6A,UR7,UR8,UR9,UR10

      REAL*8 TBF,TPMR,TAR,TAC
      REAL ABF,APMR,AAR,AAC
      REAL*8 SBF,SPMR,SAR,SAC
      REAL LBF,LPMR,LAR,LAC
      REAL UBF,UPMR,UAR,UAC

      REAL*8 TARN,TRAR,TRRE
      REAL*8 TEL,TTM,TCAP
      REAL AEL,ATM,ACAP,AARN,ARAR,ARRE
      REAL*8 SEL,STM,SCAP,SARN,SRAR,SRRE
      REAL LEL,LTM,LCAP,LARN,LRAR,LRRE
      REAL UEL,UTM,UCAP,UARN,URAR,URRE

      INTEGER REP,REPN
      PARAMETER(REPN =100)
      INTEGER LN,MMINCH,FIXTIM
      INTEGER PRERUN

101   FORMAT(I5,2F10.2,4I5)
132   FORMAT('MESSAGE ',I5,',IDXIDX(MDX) =',I5,'WILL OVERFLOW ?????')
137   FORMAT(I6,F10.4,2F8.4,3F10.4)
138   FORMAT(I6,I4,5I8)
139   FORMAT(I6,2F13.4,3I7,F10.2)
140   FORMAT(I6,F13.4,2F8.2)
141   FORMAT(I6,8F9.4)
188   FORMAT(I6,'          ','          ','          ',F9.4)
225   FORMAT(I6,F7.1,4F9.2,2F9.2,I3)
397   FORMAT ('###############   CYCLE   ##################################')
483   FORMAT ('RESERT(',I4,')=',F10.4,',  COMPLT = ',F10.4)
492   FORMAT ('MESAGE(',I4,')=',F10.4,' RSIDX= ',I5)
493   FORMAT ('  MESMIN =',F10.4,',  MESMAX = ',F10.4,',  IDXIDX=',I3)
497   FORMAT (/'MESFLG(',I4,')=',I5)
503   FORMAT ('--------------------------- TRANSMIT-----------------')
504   FORMAT ('     ------------------------------------          ')
505   FORMAT (' ----------------------------------------------------')
507   FORMAT ('--------------- BEFORE NO AVAILABLE ROOM---------------')
508   FORMAT ('-------------- AFTER  NO AVAILABLE ROOM----------------')
509   FORMAT ('------- BEFORE ARRIVE AT RECEIVER AT SAME TIME--------')
510   FORMAT ('------- AFTER ARRIVE AT RECEIVER AT SAME TIME---------')
516   FORMAT('MDX IS ',I5)
517   FORMAT('BUFAVA =',I5)
518   FORMAT('MDX IS',I5,',IDXIDX IS',I5,',(FIRST SEND)',F10.4)
519   FORMAT('MDX IS',I5,',IDXIDX IS',I5,',(NEXT SEND)',F10.4)
520   FORMAT (' >',2F12.4)
```

```
522  FORMAT('ARRMES IS',I3,',IDXIDX IS',I3,',(CANNOT FIRST )',F10.4)
527  FORMAT('TOTMIN IS  ',F10.4)
531  FORMAT (' -----GET TOTMIN,MESMIN(1-ARRMES),MESMAX-------------')
533  FORMAT (' ------------ BEFORE  CHANGE MESFLG(MDX)---')
535  FORMAT ('------MESFLG CHANG TO 3 -------------------')
536  FORMAT ('------MESFLG CHANG TO 1 -------------------')
537  FORMAT ('----  MESFLG NO CHANG   ---- --------------')
538  FORMAT ('----- MESFLG change to 2 ------------------')
539  FORMAT('BUFAVA =',I3,'  BUFTIM =  ',F10.4)
553  FORMAT('PACKNO .GT. BUFROM ,  NO MESSAGE CAN ARRIVE ')
554  FORMAT(I6,2I5,I5,F8.5,2F8.2,I5)
583  FORMAT('BUFTIM(0) =  ',F10.4)
701  FORMAT(' ',' DELTA ',' SEED NO ',' MESAGE MEAN     ',
    C'PACKET MEAN')
702  FORMAT (' ',F10.2,2X,I5,7X,2(F6.2,7X))
720  FORMAT (7(F9.4,2X))
722  FORMAT (6(I5,2X))
727  FORMAT (6(F10.2,2X))
729  FORMAT (50(1X,2I3/))
731  FORMAT (6(F10.2,2X))
739  FORMAT('I IS ',I3,'     J IS ',I2,',    M IS ',I3)
749  FORMAT (' ---- COLLET(I,J,M)   ARRIVE        -----------')
763  FORMAT ('BUFTIM  OF BUFAVA (0) IS')
764  FORMAT (6(F10.3,2X))
774  FORMAT ('AVECYT =',F10.2,',  AVECYN = ',F10.2)
775  FORMAT ('COMPLETE TIME (APPRO.) = ',F10.4)
779  FORMAT(2F30.5)
793  FORMAT ('--------------- FINAL REPORT -------------------------')
794  FORMAT ('----SPECIAL --- FINAL REPORT -------------------------')
820  FORMAT ('MESAGE (0-MESNO+1)   IS')
821  FORMAT ('MESFLG(MDX) (1-ARRMES) IS')
823  FORMAT ('PACMIN(JP) (1-PACNO) IS')
827  FORMAT ('PACFLG(JP) (1-PACNO) IS')
831  FORMAT ('MESMIN( 1-ARRMES )  IS')


     MUALPH = MUALIN + MUALSB
986  MUALPH = MUALPH - MUALSB

     MULAMD = MULAIN - MULAAD
989  MULAMD = MULAMD + MULAAD

     DELTAP = DELTIN - DELTAD
988  DELTAP = DELTAP + DELTAD

     REP=0
     ARRSTP= MESNO

     LN=LN-REP

     REP =1

     WRITE(9,554) LN,MESNO,JP,BUFROM,MUALPH,MULAMD,DELTAP,MESINI

*INST  BEGIN
*     IF (INST.EQ.1) THEN
```

```
*      PREARR = 0.
*      DO 221 I = 1,BFCLNP
*        TOARRN(I) =0
*        SDARRN(I) =0
*        TOBFCL(I) =0
*        SDBFCL(I) =0
*        TOCAPT(I) =0
*        SDCAPT(I) =0
*        TOHOLT(I) =0
*        SDHOLT(I) =0
*        TOCOMT(I) =0
*        SDCOMT(I) =0
*221   CONTINUE
*      END IF
* INST END IF

       TR1 = 0
       TR2 = 0
       TR3 = 0
       TR4 = 0
       TR5 = 0
       TR6 = 0
       TR6A = 0
       TR7 = 0
       TR8 = 0
       TR9 = 0
       TR10 = 0
       TBF = 0
       TPMR = 0
       TAR = 0
       TAC = 0
       TARN = 0
       TRAR = 0
       TRRE = 0
       TEL = 0
       TTM = 0
       TCAP = 0

       SR1 = 0
       SR2 = 0
       SR3 = 0
       SR4 = 0
       SR5 = 0
       SR6 = 0
       SR6A = 0
       SR7 = 0
       SR8 = 0
       SR9 = 0
       SR10 = 0
       SBF = 0
       SPMR = 0
       SAR = 0
       SAC = 0
       SARN = 0
       SRAR = 0
       SRRE = 0
```

```
      SEL = 0
      STM = 0
      SCAP = 0

 991  CALL SETIME

      GETNO = GETINI

      TTCLIS = 0
      TOTRES =0
      TOTCOM = 0
      TTRSIX = 0
      TTNWSD = 0
      OUTPAC = 0
      BUFAVA = BUFROM
      TOTMIN = INFITM
      MDX = 1
      ARRMES = 1

*INST  BEGIN
*     IF (INST.EQ.1) THEN
*        BFCLNO = 0
*        PREBFT = 0.
*     END IF
*INST END

      REALAR = 0
      REALRE = 0
      PRERUN = 1
      PDX = MESNO+1
      SENDX = -1
      TTPMIS = 0

            SUMINV = 0
            DO 734 II = 1,(JP-1)
                 SUMINV = SUMINV + (1. / II)
 734        CONTINUE

            COMAPP = DELTAP * SUMINV


         CALL GGEXN(ALPHSD,MUALPH,MESNO,MESEXP)
         MESAGE(0)=0
         MESAGE(MESNO+1)=INFITM

         DO 7 I =1,MESNO
            MESAGE(I)=MESAGE(I-1)+MESEXP(I)

 32   FORMAT('MESEXP=',F20.10)

            IDX(I) = 0
            IDXIDX(I) = 0
            IDXFLG(I) = 0
            RSIDX(I) = 999999999
            MESFLG(I) = 0
            MESMIN(I) = INFINI
```

```
            MAXMAX(I) = ARRIVP
            MESMAX(I) = ARRIVP
 7        CONTINUE

      AA  = MESAGE(1)
      RETTIM(1) = AA + DELTAP
      BUFTIM = 0

      DO 10 M =1,MESNO
      DO 10 I = 0,IP
      DO 10 J = 1,JP
         COLLET(I,J,M) = 0
         PACFLG(I,J,M) = 1
  10  CONTINUE

      DO 30 M =1,MESNO
      DO 30 J = 1,JP
        PACMIN(J,M) = INFINI
  30  CONTINUE

       GO TO 143

**************** IF < 0052 >
 112                IDX(MDX) = IDX(MDX) + 1
                    IDXIDX(MDX) = IDXIDX(MDX) + 1

                              MOVIDX = 0
77                            LALA = 2
                              DO 15 J = 1,JP
                                  IF(PACFLG(MOVIDX,J,MDX).NE.2)LALA=1
15                            CONTINUE

************************************ IF < 0054 >
                               IF (LALA.EQ.2)  THEN
                                  MOVIDX =MOVIDX +1
                                  GO TO 77
                                ELSE
                                   IF(MOVIDX.NE.0) THEN
                                   DO 19  I =0,(IDX(MDX)-MOVIDX-1)
                                   DO 19  J = 1,JP
                               COLLET(I,J,MDX)=COLLET((I+MOVIDX),J,MDX)
                               PACFLG(I,J,MDX)=PACFLG((I+MOVIDX),J,MDX)
 19                                CONTINUE

                                   IDXF = IDX(MDX) -1
                                   IDX(MDX) =IDX(MDX)-MOVIDX
                                   DO  22  I =IDX(MDX),IDXF
                                   DO  22  J = 1,JP

                                      PACFLG(I,J,MDX) = 1
 22                                CONTINUE
                                   END IF
                                  END IF
****************************************** END IF < 0054 >
```

```
                  IF (IDX(MDX).GE.IP) THEN
********** NEXT WRITE , ALWAYSE KEEP ON ********************
      WRITE (9,132) MDX,IDXIDX(MDX)
      WRITE(9,520) ((COLLET(I,J,MDX),J=1,JP),I=0,(IDX(MDX)-1))
      WRITE(9,823)
      WRITE(9,727) (PACMIN(J,MDX),J=1,JP)
      WRITE(9,827)
      WRITE(9,729) ((PACFLG(I,J,MDX),J=1,JP),I=0,IDX(MDX))
*     WRITE (9,134) MESSUM
********** PREVIOUS WRITE , ALWAYSE KEEP ON **************************
                           GO TO 500
                          END IF
********** END IF < 0052 >


 143    MMINCH = 0
        DO 110 J = 1,JP

********** IF < 1180 >
        IF (AA .LE. PACMIN(J,MDX))   THEN

           IF (PDX .GT. MESNO) THEN
               CALL GGEXN(LAMDSD,MULAMD,MESNO,PACKET)

               PDX = 1
               SENDX = SENDX +1
           END IF

            COLLET(IDX(MDX),J,MDX) = PACKET(PDX)+AA
            PDX =PDX+1

           IF (COLLET(IDX(MDX),J,MDX) .LT. PACMIN(J,MDX)) THEN
                  PACMIN(J,MDX)=  COLLET(IDX(MDX),J,MDX)
           END IF

           IF (COLLET(IDX(MDX),J,MDX) .LT. MESMIN(MDX)) THEN
                  MESMIN(MDX)=  COLLET(IDX(MDX),J,MDX)
                  MMINCH = MMINCH + 1
           END IF

           IF (COLLET(IDX(MDX),J,MDX) .GT. MAXMAX(MDX)) THEN
                  MAXMAX(MDX)=  COLLET(IDX(MDX),J,MDX)
           END IF

           IF(IDXFLG(MDX).EQ.0)TTNWSD=TTNWSD+1

*********  ELSE < 1180 >
        ELSE

             PACFLG(IDX(MDX),J,MDX) = 2

        END IF
********** END IF < 1180 >

 110     CONTINUE
```

```
              IDXFLG(MDX) = 1
*****************************************************************************************

      IF (MMINCH.EQ.0) GO TO 151
 150   TOTMIN = INFITM
          DO 119 M = PRERUN,ARRMES
              IF (MESFLG(M).NE.3)     TOTMIN=MIN(TOTMIN,MESMIN(M))
 119      CONTINUE

 151     DO 135 M=PRERUN,ARRMES
           IF((RETTIM(M).LE.TOTMIN).AND.(MESFLG(M).LT.2)) THEN
              AA = RETTIM(M)
              RETTIM(M) = AA + DELTAP
              MDX = M
                        GO TO 112
           END IF
 135     CONTINUE

******** IF < 1193 >
        IF((MESAGE(ARRMES+1).LE.TOTMIN).AND.((ARRMES+1).LE.MESNO)) THEN

               ARRMES = ARRMES + 1
               AA = MESAGE(ARRMES)


********************* IF < 1178 >
               IF(ARRMES.EQ.MESINI) THEN

                   IF (BUFAVA .EQ. 0) THEN
                        BUFTIM = BUFTIM + AA -TIMEBF
                        TIMEBF = AA
                   END IF

                    INITSD=(ARRMES*SENDX)+PDX-1
                    INIBUF=BUFTIM
                    INITIM= MESAGE(MESINI)
                    INITNS =TTNWSD
                    INIPMS=TTPMIS
                    INICLS=TTCLIS
                    INIOTP=OUTPAC
               END IF
********************* END IF < 1178 >

***************** IF < 1195 >
              IF(ARRMES.GE.ARRSTP) THEN
                   ARRMES = ARRMES -MESINI
                   IF (BUFAVA .EQ. 0) BUFTIM = BUFTIM + AA -TIMEBF
                   BUFTIM = BUFTIM - INIBUF
                   TOTMIN = AA -INITIM
                   TTNWSD=TTNWSD - INITNS
                   TTPMIS=TTPMIS - INIPMS
                   TTCLIS=TTCLIS - INICLS
                   OUTPAC=OUTPAC - INIOTP
                     GO TO 500
              END IF
***************** END IF < 1195 >
```

```
            RETTIM(ARRMES) = AA + DELTAP

                    MDX = ARRMES
                    GO TO 143
        END IF
******* END IF < 1193 >

********************** < 1194 >
          MCLDX = 1
          VISMES=0
          DO 182 M = PRERUN,ARRMES
              IF ((MESFLG(M).NE.3).AND.(TOTMIN.EQ.MESMIN(M))) THEN
                    VISMES = VISMES+1
                    MDX = M
                    MCLNO(MCLDX)=M
                    MCLDX=MCLDX+1
               END IF
 182      CONTINUE

        VISIT = 0
        IF(VISMES.EQ.1) THEN
            DO 181 J=1,JP
            DO 181 I=0,IDX(MDX)
         IF((TOTMIN.EQ.COLLET(I,J,MDX)).AND.(PACFLG(I,J,MDX).NE.2))THEN
                              VISIT = VISIT + 1
                              IIIDX = I
                              JDX   = J
         END IF
181         CONTINUE
        END IF

*************************** < 1194 >

*************** IF < 1217 >
             IF(VISIT.EQ.1) THEN

                              OUTPAC = OUTPAC +1
                              PACFLG(IIIDX,JDX,MDX) = 2

            MESMIN(MDX)=INFINI
            DO 162 J=1,JP
            DO 162 I=0,IDX(MDX)
                IF((PACFLG(I,J,MDX).NE.2))THEN
                    MESMIN(MDX)=MIN(MESMIN(MDX),COLLET(I,J,MDX))
                END IF
162         CONTINUE

             IF(MESFLG(MDX).EQ.1) THEN
                   MESMAX(MDX) = ARRIVP
                DO 161 JJ = 1,JP
                   MESMAX(MDX) = MAX(MESMAX(MDX),PACMIN(JJ,MDX))
 161            CONTINUE
             END IF

***************  ELSE < 1217 >
```

```
              ELSE
                  DO 122 M=1,(MCLDX-1)
                  DO 122 J=1,JP
                  DO 122 I=0,IDX(MCLNO(M))

                    IF((TOTMIN.EQ.COLLET(I,J,MCLNO(M))).AND.
     C(PACFLG(I,J,MCLNO(M)).NE.2))THEN


                                OUTPAC = OUTPAC +1
                                PACFLG(I,J,MCLNO(M)) = 2
                                TTCLIS = TTCLIS + 1

****** IF < 1441 >
       IF(PACMIN(J,MCLNO(M)).EQ.COLLET(I,J,MCLNO(M))) THEN
*DT
*                       COLLET(I,J,MCLNO(M)) = COLLIS
                        PACMIN(J,MCLNO(M)) =INFINI
                  DO 144 I1 = 0,IDX(MCLNO(M))
                     IF (PACFLG(I1,J,MCLNO(M)).NE.2) THEN
      PACMIN(J,MCLNO(M))=MIN(PACMIN(J,MCLNO(M)),COLLET(I1,J,MCLNO(M)))
                     END IF
 144              CONTINUE
         END IF
******** END IF < 1441 >

******* IF < 1382 >
       IF ((MESFLG(MCLNO(M)).EQ.2).AND.
     C(MAXMAX(MCLNO(M)).EQ.TOTMIN)) THEN

              MESFLG(MCLNO(M)) = 3

 92           IF((MESFLG(PRERUN).EQ.3).AND.(PRERUN.LT.MESNO))THEN
                   PRERUN = PRERUN + 1
                   GO TO 92
              END IF

       END IF
******* END IF < 1382 >

                           END IF
 122                 CONTINUE


             DO 123 M=1,(MCLDX-1)
             MESMIN(MCLNO(M))=INFINI
             DO 123 J=1,JP
             DO 123 I=0,IDX(MCLNO(M))
                IF((PACFLG(I,J,MCLNO(M)).NE.2))THEN
      MESMIN(MCLNO(M))=MIN(MESMIN(MCLNO(M)),COLLET(I,J,MCLNO(M)))
                END IF
123          CONTINUE
                           GO TO 150
              END IF
**************** END IF < 1217 >
```

```
********** IF  < 1380 >
 380        IF ((MESMAX(MDX) .EQ. TOTMIN).AND.(MESFLG(MDX).EQ.1)) THEN
                MESFLG(MDX) = 2

                     IF (BUFAVA .EQ. 0) THEN
                         BUFTIM = BUFTIM + TOTMIN -TIMEBF

                     END IF
                         TIMEBF = TOTMIN

                BUFAVA = BUFAVA + JP


             END IF
********** END IF < 1380 >

******* IF < 1381 >
 381    IF ((MESFLG(MDX).EQ.2).AND.(MAXMAX(MDX).EQ.TOTMIN)) THEN

              MESFLG(MDX) = 3


*INST BEGIN
*      IF (INST.EQ.1) THEN
*              TIMINT= TOTMIN-PREARR
*              PREARR = TOTMIN
*
*              BFCLNO = BFCLNO + 1
*              ARRNO(BFCLNO-1)= ARRMES

*              IF (BUFAVA .EQ. 0) THEN
*                  BUFTIM = BUFTIM + TOTMIN -TIMEBF
*                  TIMEBF =TOTMIN
*              END IF
*              BUFCOL(BFCLNO)= (BUFTIM-PREBFT) / TIMINT
*              PREBFT = BUFTIM

*                  MESMIN(MDX)=INFINI
*               DO 777 J = 1,JP
*                   MESMIN(MDX) =MIN(MESMIN(MDX),PACMIN(J,MDX))
*777            CONTINUE
*              CAPCOL(BFCLNO) = MESMIN(MDX)-MESAGE(MDX)
*              HOLCOL(BFCLNO) = MESMAX(MDX)-MESAGE(MDX)
*              COMCOL(BFCLNO) = CAPCOL(BFCLNO)+HOLCOL(BFCLNO)
*      END IF
*INST END

 91           IF((MESFLG(PRERUN).EQ.3).AND.(PRERUN.LT.MESNO))THEN
                   PRERUN = PRERUN + 1
                   GO TO 91
              END IF

              GO TO 150
        END IF
******** END IF < 1381 >
```

```
********** IF  < 1410 >
           IF (((BUFAVA-JP).GE. 0).AND.(MESFLG(MDX).EQ. 0)) THEN

                RSIDX(MDX) = IDXIDX(MDX)

                TIMEBF = TOTMIN
                BUFAVA = BUFAVA -JP
                MESFLG(MDX) = 1


             GO TO 150

           END IF
********** END IF  < 1410 >


********** IF  < 1420 >
           IF (MESFLG(MDX).EQ.0)  THEN

                    PACMIN(JDX,MDX) =INFINI
                    TTPMIS =TTPMIS + 1

                    DO 145 I1 = 0,IDX(MDX)
              IF (PACFLG(I1,JDX,MDX).NE.2) THEN
              PACMIN(JDX,MDX) =MIN(PACMIN(JDX,MDX),COLLET(I1,JDX,MDX))
              END IF
 145                CONTINUE

           GO TO 150
           END IF
********** END IF < 1420 >

       GO TO 150

********** 1515 FINAL DATA COLLECTION
500    DO 495 M = MESINI,ARRSTP
          MESMIN(M) =INFINI
          IF(MESFLG(M).GE.1) THEN
          DO 491 J = 1,JP
             MESMIN(M) = MIN(MESMIN(M),PACMIN(J,M))
 491      CONTINUE
          END IF
495    CONTINUE


        DO 768 M = MESINI,ARRSTP
          IF (MESFLG(M).GE.1)  THEN
             TTRSIX =TTRSIX + RSIDX(M)

             TOTRES =TOTRES + MESMIN(M)-MESAGE(M)
             REALRE = REALRE +1
          END IF

          IF (MESFLG(M).GE.2)  THEN
```

```
            TOTCOM =TOTCOM + MESMAX(M)-MESMIN(M)
            REALAR = REALAR + 1
           END IF

768      CONTINUE

             TTPMIS = TTPMIS+TTCLIS
             TTSEND = (MESNO *SENDX)+PDX-1-INITSD
             PMISRA = 1.0*TTPMIS/OUTPAC
             AVERES = TOTRES /REALRE
             AVECOM = TOTCOM / REALAR

       BUFRC = BUFTIM / TOTMIN

       R1 =  TTSEND/TOTMIN
       R2 =  TTNWSD/TOTMIN
       R3 =  (TTSEND-TTNWSD)/TOTMIN
       R4 =  (JP*REALAR)/TOTMIN
       R5 =  REALAR/TOTMIN
       R6A =  TTCLIS/ TOTMIN
       R6 =  TTPMIS/TOTMIN
       R7 =  (OUTPAC-TTPMIS)/TOTMIN
       R8 =  (1.0*TTRSIX/REALRE)+1
       R9 =  AVERES+AVECOM
       R10=  REALRE/TOTMIN


       CALL GETIME (IET)
       EL = IET * .000026

       IF(TTPMIS.GT.0) THEN
       RSPAAP=SQRT(1.0*ACOS(-1.)*MULAMD*DELTAP*TTSEND/(2*JP*TTPMIS))
       ELSE
       RSPAAP=INFINI
       END IF

*D1    WRITE(12,188) LN,R6
*D1    WRITE(12,141) LN,R1,R2,R3,R6A,R4,R5,R7,R10
*D1    WRITE(14,137) LN,R8,PMISRA,BUFRC,AVERES,AVECOM,R9

*D1    WRITE(16,138)LN,IP,TTSEND,TTNWSD,TTPMIS,(TTRSIX+REALRE),OUTPAC
*D1    WRITE(17,139)LN,MESAGE(MESINI),TOTMIN,ARRMES,REALAR,REALRE,EL
*D1    WRITE(18,140)LN,BUFTIM,RSPAAP,COMAPP

         LN =LN + 1

       IF(REPN.EQ.1 ) GO TO 997

*INST BEGIN
*      IF (INST.EQ.1) THEN
*      DO 222 I = 1,BFCLNO
*        TOARRN(I) =TOARRN(I)+ARRNO(I)
*        SDARRN(I) =SDARRN(I)+ARRNO(I)**2
*        TOBFCL(I) =TOBFCL(I)+BUFCOL(I)
*        SDBFCL(I) =SDBFCL(I)+BUFCOL(I)**2
*        TOCAPT(I) =TOCAPT(I)+CAPCOL(I)
```

```
*        SDCAPT(I) =SDCAPT(I)+CAPCOL(I)**2
*        TOHOLT(I) =TOHOLT(I)+HOLCOL(I)
*        SDHOLT(I) =SDHOLT(I)+HOLCOL(I)**2
*        TOCOMT(I) =TOCOMT(I)+COMCOL(I)
*        SDCOMT(I) =SDCOMT(I)+COMCOL(I)**2
*222   CONTINUE
*      END IF

*INST END

       TR1 = TR1 +R1
       TR2 = TR2 +R2
       TR3 = TR3 +R3
       TR4 = TR4 +R4
       TR5 = TR5 +R5
       TR6 = TR6 +R6
       TR6A = TR6A +R6A
       TR7 = TR7 +R7
       TR8 = TR8 +R8
       TR9 = TR9 +R9
       TR10 = TR10 +R10
       TBF = TBF +BUFRC
       TPMR = TPMR +PMISRA
       TAR = TAR +AVERES
       TAC = TAC +AVECOM
       TARN = TARN +ARRMES
       TRAR = TRAR +REALAR
       TRRE = TRRE +REALRE
       TEL = TEL +EL
       TTM = TTM +TOTMIN
       TCAP = TCAP +RSPAAP

       SR1 = SR1 +R1**2
       SR2 = SR2 +R2**2
       SR3 = SR3 +R3**2
       SR4 = SR4 +R4**2
       SR5 = SR5 +R5**2
       SR6 = SR6 +R6**2
       SR6A = SR6A +R6A**2
       SR7 = SR7 +R7**2
       SR8 = SR8 +R8**2
       SR9 = SR9 +R9**2
       SR10 = SR10 +R10**2
       SBF = SBF +BUFRC**2
       SPMR = SPMR +PMISRA**2
       SAR = SAR +AVERES**2
       SAC = SAC +AVECOM**2
       SARN = SARN +ARRMES**2
       SRAR = SRAR +REALAR**2
       SRRE = SRRE +REALRE**2

       SEL = SEL +EL**2
       STM = STM +TOTMIN**2
       SCAP = SCAP +RSPAAP**2

       IF(REP.EQ.REPN) GO TO 995
```

```
        REP = REP +1
      GO TO 991

 995  WRITE(9,504)
*D1   WRITE(12,504)
*D1   WRITE(14,504)
*D1   WRITE(16,504)
*D1   WRITE(17,504)
*D1   WRITE(18,504)

*INST BEGIN
*     IF (INST.EQ.1) THEN
*     DO 223 I = 1,BFCLNO
*       AVARRN(I) =1.0*TOARRN(I)/REP
*       SDARRN(I) = ((((SDARRN(I)*REP)-(TOARRN(I)**2))/(REP*(REP-1)))
*    C/REP)

*     IF (SDARRN(I).GE.0)  THEN
*        SDARRN(I) = SDARRN(I) ** (1./2)
*     ELSE
*     WRITE(29,457) LN,I,SDARRN(I)
*457  FORMAT('LN=',I6,' SDARRN(',I3,')',F50.30)
*        SDARRN(I) = 0
*     END IF

*       UPARRN(I) = AVARRN(I)+1.96*SDARRN(I)
*       LOARRN(I) = AVARRN(I)-1.96*SDARRN(I)

*       AVBFCL(I) =TOBFCL(I)/REP
*       SDBFCL(I) = ((((SDBFCL(I)*REP)-(TOBFCL(I)**2))/(REP*(REP-1)))
*    C/REP)

*     IF (SDBFCL(I).GE.0)  THEN
*        SDBFCL(I) = SDBFCL(I) ** (1./2)
*     ELSE
*     WRITE(29,450) LN,I,SDBFCL(I)
*450  FORMAT('LN=',I6,' SDBFCL(',I3,')',F50.30)
*        SDBFCL(I) = 0
*     END IF

*       UPBFBK(I) = AVBFCL(I)+1.96*SDBFCL(I)
*       LOBFBK(I) = AVBFCL(I)-1.96*SDBFCL(I)

*     WRITE(32,21) LN,LOARRN(I),AVARRN(I),UPARRN(I),LOBFBK(I),AVBFCL(I),
*    CUPBFBK(I)
* 21  FORMAT(I6,3F7.2,3F7.4)

*       AVCAPT(I) =TOCAPT(I)/REP
*       SDCAPT(I) = ((((SDCAPT(I)*REP)-(TOCAPT(I)**2))/(REP*(REP-1)))
*    C/REP)

*     IF (SDCAPT(I).GE.0)  THEN
*        SDCAPT(I) = SDCAPT(I) ** (1./2)
*     ELSE
*     WRITE(29,452) LN,I,SDCAPT(I)
*452  FORMAT('LN=',I6,' SDCAPT(',I3,')',F50.30)
```

```
*         SDCAPT(I) = 0
*      END IF

*        UPCAPT(I) = AVCAPT(I)+1.96*SDCAPT(I)
*        LOCAPT(I) = AVCAPT(I)-1.96*SDCAPT(I)

*        AVHOLT(I) =TOHOLT(I)/REP
*        SDHOLT(I) = ((((SDHOLT(I)*REP)-(TOHOLT(I)**2))/(REP*(REP-1)))
*     C/REP)

*      IF (SDHOLT(I).GE.0)  THEN
*         SDHOLT(I) = SDHOLT(I) ** (1./2)
*      ELSE
*      WRITE(29,453) LN,I,SDHOLT(I)
*453   FORMAT('LN=',I6,' SDHOLT(',I3,')',F50.30)
*         SDHOLT(I) = 0
*      END IF
*        UPHOLT(I) = AVHOLT(I)+1.96*SDHOLT(I)
*        LOHOLT(I) = AVHOLT(I)-1.96*SDHOLT(I)

*        AVCOMT(I) =TOCOMT(I)/REP
*        SDCOMT(I) = ((((SDCOMT(I)*REP)-(TOCOMT(I)**2))/(REP*(REP-1)))
*     C/REP)

*      IF (SDCOMT(I).GE.0)  THEN
*         SDCOMT(I) = SDCOMT(I) ** (1./2)
*      ELSE
*      WRITE(29,454) LN,I,SDCOMT(I)
*454   FORMAT('LN=',I6,' SDCOMT(',I3,')',F50.30)
*         SDCOMT(I) = 0
*      END IF

*        UPCOMT(I) = AVCOMT(I)+1.96*SDCOMT(I)
*        LOCOMT(I) = AVCOMT(I)-1.96*SDCOMT(I)

*      WRITE(31,31) LN,AVARRN(I),LOCAPT(I),AVCAPT(I),UPCAPT(I),LOHOLT(I),
*     CAVHOLT(I),UPHOLT(I),LOCOMT(I),AVCOMT(I),UPCOMT(I)
* 31   FORMAT(I6,F7.2,9F7.2)
*223   CONTINUE

*      END IF
*INST END ******** COMMEND


       AR1 = TR1/REP
       AR2 = TR2/REP
       AR3 = TR3/REP
       AR4 = TR4/REP
       AR5 = TR5/REP
       AR6 = TR6/REP
       AR6A = TR6A/REP
       AR7 = TR7/REP
       AR8 = TR8/REP
       AR9 = TR9/REP
       AR10 = TR10/REP
       ABF = TBF /REP
```

```
      APMR = TPMR /REP
      AAR = TAR /REP
      AAC = TAC /REP

      AARN = 1.0*TARN /REP
      ARAR = 1.0*TRAR /REP
      ARRE = 1.0*TRRE /REP
      AEL = TEL /REP
      ATM = TTM /REP
      ACAP = TCAP /REP

      SR1 = ((((SR1*REP)-(TR1**2))/(REP*(REP-1)))/REP)
      SR2 = ((((SR2*REP)-(TR2**2))/(REP*(REP-1)))/REP)
      SR3 = ((((SR3*REP)-(TR3**2))/(REP*(REP-1)))/REP)
      SR4 = ((((SR4*REP)-(TR4**2))/(REP*(REP-1)))/REP)
      SR5 = ((((SR5*REP)-(TR5**2))/(REP*(REP-1)))/REP)
      SR6 = ((((SR6*REP)-(TR6**2))/(REP*(REP-1)))/REP)
      SR6A = ((((SR6A*REP)-(TR6A**2))/(REP*(REP-1)))/REP)
      SR7 = ((((SR7*REP)-(TR7**2))/(REP*(REP-1)))/REP)
      SR8 = ((((SR8*REP)-(TR8**2))/(REP*(REP-1)))/REP)
      SR9 = ((((SR9*REP)-(TR9**2))/(REP*(REP-1)))/REP)
      SR10 = ((((SR10*REP)-(TR10**2))/(REP*(REP-1)))/REP)
      SBF = ((((SBF*REP)-(TBF**2))/(REP*(REP-1)))/REP)
      SPMR = ((((SPMR*REP)-(TPMR**2))/(REP*(REP-1)))/REP)
      SAR = ((((SAR*REP)-(TAR**2))/(REP*(REP-1)))/REP)
      SAC = ((((SAC*REP)-(TAC**2))/(REP*(REP-1)))/REP)

      SARN = ((((SARN*REP)-(TARN**2))/(REP*(REP-1)))/REP)
      SRAR = ((((SRAR*REP)-(TRAR**2))/(REP*(REP-1)))/REP)
      SRRE = ((((SRRE*REP)-(TRRE**2))/(REP*(REP-1)))/REP)
      SEL = ((((SEL*REP)-(TEL**2))/(REP*(REP-1)))/REP)
      STM = ((((STM*REP)-(TTM**2))/(REP*(REP-1)))/REP)
      SCAP = ((((SCAP*REP)-(TCAP**2))/(REP*(REP-1)))/REP)


      IF (SR1.GE.0)  THEN
         SR1 = SR1 ** (1./2)
      ELSE
      WRITE(29,423) LN,SR1
  423 FORMAT('LN=',I6,' SR1=',F60.30)
         SR1 = 0
      END IF

      IF (SR2.GE.0)  THEN
         SR2 = SR2 ** (1./2)
      ELSE
      WRITE(29,424) LN,SR2
  424 FORMAT('LN=',I6,' SR2=',F60.30)
         SR2 = 0
      END IF

      IF (SR3.GE.0)  THEN
         SR3 = SR3 ** (1./2)
      ELSE
      WRITE(29,425) LN,SR3
  425 FORMAT('LN=',I6,' SR3=',F60.30)
```

```
      SR3 = 0
    END IF

    IF (SR4.GE.0)  THEN
      SR4 = SR4 ** (1./2)
    ELSE
    WRITE(29,426) LN,SR4
426 FORMAT('LN=',I6,' SR4=',F60.30)
      SR4 = 0
    END IF

    IF (SR5.GE.0)  THEN
      SR5 = SR5 ** (1./2)
    ELSE
    WRITE(29,427) LN,SR5
427 FORMAT('LN=',I6,' SR5=',F60.30)
      SR5 = 0
    END IF

    IF (SR6.GE.0)  THEN
      SR6 = SR6 ** (1./2)
    ELSE
    WRITE(29,428) LN,SR6
428 FORMAT('LN=',I6,' SR6=',F60.30)
      SR6 = 0
    END IF

    IF (SR6A.GE.0)  THEN
      SR6A = SR6A ** (1./2)
    ELSE
    WRITE(29,445) LN,SR6A
445 FORMAT('LN=',I6,' SR6A=',F60.30)
      SR6A = 0
    END IF

    IF (SR7.GE.0)  THEN
      SR7 = SR7 ** (1./2)
    ELSE
    WRITE(29,429) LN,SR7
429 FORMAT('LN=',I6,' SR7=',F60.30)
      SR7 = 0
    END IF

    IF (SR8.GE.0)  THEN
      SR8 = SR8 ** (1./2)
    ELSE
    WRITE(29,430) LN,SR8
430 FORMAT('LN=',I6,' SR8=',F60.30)
      SR8 = 0
    END IF

    IF (SR9.GE.0)  THEN
      SR9 = SR9 ** (1./2)
    ELSE
    WRITE(29,431) LN,SR9
431 FORMAT('LN=',I6,' SR9=',F60.30)
```

```
      SR9 = 0
    END IF

    IF (SR10.GE.0)  THEN
      SR10 = SR10 ** (1./2)
    ELSE
    WRITE(29,432) LN,SR10
432 FORMAT('LN=',I6,' SR10=',F60.30)
      SR10 = 0
    END IF

    IF (SBF.GE.0)  THEN
      SBF = SBF ** (1./2)
    ELSE
    WRITE(29,434) LN,SBF
434 FORMAT('LN=',I6,' SBF=',F60.30)
      SBF = 0
    END IF

    IF (SPMR.GE.0)  THEN
      SPMR = SPMR ** (1./2)
    ELSE
    WRITE(29,435) LN,SPMR
435 FORMAT('LN=',I6,' SPMR=',F60.30)
      SPMR = 0
    END IF

    IF (SAR.GE.0)  THEN
      SAR = SAR ** (1./2)
    ELSE
    WRITE(29,436) LN,SAR
436 FORMAT('LN=',I6,' SAR=',F60.30)
      SAR = 0
    END IF

    IF (SAC.GE.0)  THEN
      SAC = SAC ** (1./2)
    ELSE
    WRITE(29,437) LN,SAC
437 FORMAT('LN=',I6,' SAC=',F60.30)
      SAC = 0
    END IF

    IF (SARN.GE.0)  THEN
      SARN = SARN ** (1./2)
    ELSE
    WRITE(29,438) LN,SARN
438 FORMAT('LN=',I6,' SARN=',F60.30)
      SARN = 0
    END IF

    IF (SRAR.GE.0)  THEN
      SRAR = SRAR ** (1./2)
    ELSE
    WRITE(29,439) LN,SRAR
439 FORMAT('LN=',I6,' SRAR=',F60.30)
```

```
      SRAR = 0
    END IF

    IF (SRRE.GE.0)  THEN
      SRRE = SRRE ** (1./2)
    ELSE
    WRITE(29,440) LN,SRRE
440 FORMAT('LN=',I6,' SRRE=',F60.30)
      SRRE = 0
    END IF

    IF (SEL.GE.0)  THEN
      SEL = SEL ** (1./2)
    ELSE
    WRITE(29,441) LN,SEL
441 FORMAT('LN=',I6,' SEL=',F60.30)
      SEL = 0
    END IF

    IF (STM.GE.0)  THEN
      STM = STM ** (1./2)
    ELSE
    WRITE(29,442) LN,STM
442 FORMAT('LN=',I6,' STM=',F60.30)
      STM = 0
    END IF

    IF (SCAP.GE.0)  THEN
      SCAP = SCAP ** (1./2)
    ELSE
    WRITE(29,443) LN,SCAP
443 FORMAT('LN=',I6,' SCAP=',F60.30)
      SCAP = 0
    END IF

    LR1 = AR1-1.96*SR1
    UR1 = AR1+1.96*SR1
    LR2 = AR2-1.96*SR2
    UR2 = AR2+1.96*SR2
    LR3 = AR3-1.96*SR3
    UR3 = AR3+1.96*SR3
    LR4 = AR4-1.96*SR4
    UR4 = AR4+1.96*SR4
    LR5 = AR5-1.96*SR5
    UR5 = AR5+1.96*SR5
    LR6 = AR6-1.96*SR6
    UR6 = AR6+1.96*SR6
    LR6A = AR6A-1.96*SR6A
    UR6A = AR6A+1.96*SR6A
    LR7 = AR7-1.96*SR7
    UR7 = AR7+1.96*SR7
    LR8 = AR8-1.96*SR8
    UR8 = AR8+1.96*SR8
    LR9 = AR9-1.96*SR9
    UR9 = AR9+1.96*SR9
    LR10 = AR10-1.96*SR10
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```
      UR10 = AR10+1.96*SR10
      LBF = ABF-1.96*SBF
      UBF = ABF+1.96*SBF
      LPMR = APMR-1.96*SPMR
      UPMR = APMR+1.96*SPMR
      LAR = AAR-1.96*SAR
      UAR = AAR+1.96*SAR
      LAC = AAC-1.96*SAC
      UAC = AAC+1.96*SAC

      LARN = AARN-1.96*SARN
      UARN = AARN+1.96*SARN
      LRAR = ARAR-1.96*SRAR
      URAR = ARAR+1.96*SRAR
      LRRE = ARRE-1.96*SRRE.
      URRE = ARRE+1.96*SRRE
      LEL = AEL-1.96*SEL
      UEL = AEL+1.96*SEL
      LTM = ATM-1.96*STM
      UTM = ATM+1.96*STM
      LCAP = ACAP-1.96*SCAP
      UCAP = ACAP+1.96*SCAP

      WRITE(13,188) LN,LR6
      WRITE(13,188) LN,AR6
      WRITE(13,188) LN,UR6

      WRITE(13,141) LN,LR1,LR2,LR3,LR6A,LR4,LR5,LR7,LR10
      WRITE(13,141) LN,AR1,AR2,AR3,AR6A,AR4,AR5,AR7,AR10
      WRITE(13,141) LN,UR1,UR2,UR3,UR6A,UR4,UR5,UR7,UR10

      WRITE(15,137) LN,LR8,LPMR,LBF,LAR,LAC,LR9

      WRITE(15,137) LN,AR8,APMR,ABF,AAR,AAC,AR9

      WRITE(15,137) LN,UR8,UPMR,UBF,UAR,UAC,UR9

      WRITE(22,225) LN,LEL,LTM,LARN,LRAR,LRRE,LCAP

      WRITE(22,225) LN,AEL,ATM,AARN,ARAR,ARRE,ACAP,COMAPP,REP

      WRITE(22,225) LN,UEL,UTM,UARN,URAR,URRE,UCAP

      WRITE(13,504)
      WRITE(15,504)
      WRITE(22,504)


997   IF(DELTAP.EQ.DELTED) GO TO 993
      GO TO 988

993   IF(MULAMD.EQ.MULAED) GO TO 992
      GO TO 989

992   IF((MUALPH-MUALED).LT.0.0000001) GO TO 998
```

```
      GO TO 986


 998  WRITE(9,505)
*D1   WRITE(12,505)
      WRITE(13,505)
*D1   WRITE(14,505)
      WRITE(15,505)
*D1   WRITE(16,505)
*D1   WRITE(17,505)
*D1   WRITE(18,505)
*     WRITE(21,505)
      WRITE(22,505)

 999  RETURN
      END
*********************************************************************
*/*
*//GO.FT09F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT11F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT12F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT13F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT14F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT15F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT16F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT17F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT18F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT21F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT22F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT29F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT30F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT31F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//GO.FT32F001 DD SYSOUT=B,DCB=BLKSIZE=80
*//
```

APPENDIX B. RAW DATA VALUES

A. DICTIONARY OF ABBREVIATIONS

ARRIVING : the sequence number of the messages arriving at the transmitter
ARRMES : number of the messages between the data collection criteria and stopping criteria.
AVG.ATT : average number of transmissions before a message could capture the buffer.
ATTRITI : upper : total missing packets in one time unit.
below : total collision packets in one time unit.
B.C : buffer size.
BUFAVA : available buffer room.
BUFTIM(0) : the total elapsed time when not enough space is available for one message at receiver buffer.
CAP : capture time.
CAP.P.P : estimated value for capture time.
CAP.T : capture time.
COM : message completion time.
COMPLT : buffer holding time.
COM.T : message completion time.
C.P.U. : C.P.U. time in main frame.
DEL : re-transmisson time interval.
HOL : buffer holding time.
HOLD : buffer holding time.
HOLD.T : buffer holding time.
HOL.P : estimated value of the buffer holding time.
I : index for line used in memory space.
IDXIDX : total transmission or re-transmission times for this message.
J : index for column used in memory space.
LN : line numbers for data listing.
M : index for message data record in memory space.
MDX : the sequence number for message being transmitted.
MESFLG : message flag.
MESAGE : the time that the message started being transmitted.
MESMAX : the time that the last packet arrives for message completion.
MESMIN : the time that the first packet captured the receiver buffer.
MFLG : message flag
MIDX : transmission or re-transmission count for this message.
MISS.P : the ratio of total missing packets to the total packets arriving at the receiver buffer.
M.N : stopping criteria.
M.REC : total messages received at the receiver buffer in one unit of time.
N.TRAN : total packets initially transmitted in one unit of time.
OUT.SY : total packets arriving at the receiver buffer (including missing packets and duplication packets) in one unit time.
PACFLG : packet flag.
PACMIN : the earlist time of arrival for each packet (original or retransmitted) at receiver buffer.
P.REC : total packets received at the receiver buffer in one unit

of time.

P.M : mean value of network transit time.

P.N : message size.

REAL.AR : total number of messages actually received between the data collection criteria and stopping criteria.

REAL.RE : total number of messages which actually captured the receiver buffer between the data collection criteria and stopping criteria.

REC.BK : percentage of receiver buffer blocking.

REP : total number of random seeds.

RES : total number of messages which captured the receiver buffer in one unit of time.

RESERT : capture time for the message.

RE.TRAN : total packets retransmitted in one unit of time.

RIDX : the number of message retransmissions before the first packet captured the receiver buffer.

RSIDX : the number of message retransmissions before the first packet captured the receiver buffer.

TIME : total length of time between data collection criteria and stopping criteria.

TOTMIN : time of next event at receiver buffer.

T.TRAN : total packets originally transmitted or retransmitted in one unit of time.

B. DATA LISTING - PART 1

LN	M.N	P.N	B.C	M.M	P.M	DEL	
20100	6	2	2	2.00000	4.00	4.00	2

LN	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
20100				0.3635				
20100	1.4540	0.9693	0.4847	0.0000	0.2423	0.1212	0.6058	0.2423
20101				0.9549				
20101	2.0053	0.7639	1.2414	0.0000	0.1910	0.0955	0.4775	0.1910

AVER	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
20102				0.0796				
20102				0.6592				
20102				1.2388				
20102	1.1893	0.6653	0.1214	0.0000	0.1663	0.0832	0.4158	0.1663
20102	1.7296	0.8666	0.8630	0.0000	0.2167	0.1083	0.5416	0.2167
20102	2.2700	1.0679	1.6046	0.0000	0.2670	0.1335	0.6674	0.2670

LN	AVG.ATT	MISS.P	REC.BK	CAP.T	HOLD.T	COMP.T
20100	2.0000	0.3750	0.5584	4.9180	1.5837	6.5016
20101	1.5000	0.6667	0.8412	4.5543	5.1162	9.6705

AVER	AVG.ATT	MISS.P	REC.BK	CAP.T	HOLD.T	COMP.T
20102	1.2600	0.2350	0.4227	4.3798	-0.1119	4.9806
20102	1.7500	0.5208	0.6998	4.7362	3.3499	8.0861
20102	2.2400	0.8067	0.9769	5.0925	6.8118	11.1916

LN	IP	TSEND	NSEND	P.MIS	T.RIDX	OUTPAC
20100	3	12	8	3	4	8
20101	3	21	8	10	3	15

B. DATA LISTING _ PART 1 (CONTINUED)

LN	M(INI)	TOTMIN	ARR.M	RL.AR	RL.RE	C.P.U
20100	6.2065	8.2534	4	1	2	0.00
20101	0.9653	10.4722	4	1	2	0.00

LN	REC.0	CAPP.AP	HOLD.AP
20100	4.6088	7.09	4.00
20101	8.8091	5.14	4.00

AVER	C.P.U	TIME	ARRMES	REAL.AR	REAL.RE	CAP.P.P	HOL.P	REP
20102	0.0	7.19	4.00	1.00	2.00	4.20		
20102	0.0	9.36	4.00	1.00	2.00	6.11	4.00	2
20102	0.0	11.54	4.00	1.00	2.00	8.03		

C. DATA LISTING - PART 2

LN	M.N	P.N	B.C	M.M	P.M	DEL	
20100	6	2	2	2.00000	4.00	4.00	2

AVER	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
20102				0.0796				
20102				0.6592				
20102				1.2388				
20102	1.1893	0.6653	0.1214	0.0000	0.1663	0.0832	0.4158	0.1663
20102	1.7296	0.8666	0.8630	0.0000	0.2167	0.1083	0.5416	0.2167
20102	2.2700	1.0679	1.6046	0.0000	0.2670	0.1335	0.6674	0.2670

AVER	AVG.ATT	MISS.P	REC.BK	CAP.T	HOLD.T	COMP.T
20102	1.2600	0.2350	0.4227	4.3798	-0.1119	4.9806
20102	1.7500	0.5208	0.6998	4.7362	3.3499	8.0861
20102	2.2400	0.8067	0.9769	5.0925	6.8118	11.1916

AVER	C.P.U	TIME	ARRMES	REAL.AR	REAL.RE	CAP.P.P	HOL.P	REP
20102	0.0	7.19	4.00	1.00	2.00	4.20		
20102	0.0	9.36	4.00	1.00	2.00	6.11	4.00	2
20102	0.0	11.54	4.00	1.00	2.00	8.03		

1. DATA FOR TRANSIENT STATE ANALYSIS

Table 10. VALUE OF PARAMETERS USED DURING TRANSIENT ANALYSIS.

Parameter used :					
Mes. No.	Mes. Size	Buf. Size	Mes. Inter.	Tran. Time	Retrans. Time
3000	5	22 mes.	2	24	24

LN	ARRIVING			REC. BK		
52300	20.66	21.74	22.82	0.0000	0.0000	0.0000
give		25.08		0.0000	0.0000	0.0000
52300	23.99	25.09	26.19	0.0122	0.0408	0.0694
52300	26.63	27.67	28.71	0.0159	0.0489	0.0820
52300	29.22	30.26	31.30	0.0200	0.0551	0.0902
52300	31.54	32.56	33.58	0.0206	0.0590	0.0974
52300	33.48	34.55	35.62	0.0424	0.0873	0.1323
52300	35.49	36.60	37.71	0.0395	0.0844	0.1292
52300	36.85	37.98	39.11	0.0463	0.0918	0.1373
52300	38.47	39.62	40.77	0.0713	0.1295	0.1877
52300	40.14	41.28	42.42	0.0352	0.0743	0.1135
52300	41.35	42.52	43.69	0.0322	0.0761	0.1200
52300	43.00	44.13	45.26	0.0349	0.0773	0.1198
52300	44.36	45.50	46.64	0.0497	0.1028	0.1558
52300	46.00	47.14	48.28	0.0543	0.1075	0.1607
52300	47.09	48.32	49.55	0.0446	0.0911	0.1375
52300	48.70	49.91	51.12	0.0618	0.1150	0.1682
52300	49.65	50.89	52.13	0.0496	0.1013	0.1529
52300	50.84	52.10	53.36	0.0364	0.0836	0.1308
52300	51.94	53.15	54.36	0.0557	0.1076	0.1594
52300	52.96	54.22	55.48	0.0507	0.1086	0.1665
52300	54.06	55.32	56.58	0.0311	0.0769	0.1228
52300	55.05	56.30	57.55	0.0253	0.0714	0.1175
52300	56.26	57.55	58.84	0.0389	0.0863	0.1337
52300	57.13	58.44	59.75	0.0391	0.0844	0.1297
52300	58.52	59.80	61.08	0.0468	0.0977	0.1486
52300	59.38	60.68	61.98	0.0735	0.1299	0.1863
52300	60.54	61.87	63.20	0.0764	0.1366	0.1968
52300	61.80	63.11	64.42	0.0531	0.1071	0.1610
52300	63.04	64.33	65.62	0.0553	0.1119	0.1685
52300	64.36	65.67	66.98	0.0711	0.1339	0.1966
52300	65.18	66.48	67.78	0.0742	0.1348	0.1954
52300	66.41	67.67	68.93	0.0524	0.1084	0.1643
52300	67.46	68.69	69.92	0.0524	0.1012	0.1501
52300	68.29	69.51	70.73	0.0868	0.1493	0.2118
52300	69.35	70.61	71.87	0.0557	0.1101	0.1646
52300	70.23	71.51	72.79	0.0606	0.1182	0.1757
52300	71.50	72.79	74.08	0.0656	0.1213	0.1770
52300	72.31	73.56	74.81	0.0869	0.1493	0.2116

52300	73.20	74.42	75.64	0.0711	0.1325	0.1939
52300	74.12	75.38	76.64	0.0594	0.1127	0.1661
52300	75.10	76.39	77.68	0.0309	0.0806	0.1302
52300	75.97	77.28	78.59	0.0497	0.1034	0.1570
52300	77.14	78.40	79.66	0.0661	0.1259	0.1858
52300	78.30	79.57	80.84	0.0673	0.1245	0.1816
52300	79.32	80.58	81.84	0.0323	0.0739	0.1154
52300	80.51	81.72	82.93	0.0424	0.0903	0.1381
52300	81.56	82.82	84.08	0.0525	0.1013	0.1501
52300	82.69	83.89	85.09	0.0817	0.1432	0.2047
52300	83.66	84.85	86.04	0.0542	0.1093	0.1644
52300	84.64	85.89	87.14	0.0686	0.1281	0.1876
52300	85.47	86.72	87.97	0.0876	0.1497	0.2118
52300	86.56	87.79	89.02	0.0960	0.1631	0.2302
52300	87.68	88.91	90.14	0.0749	0.1378	0.2007
52300	88.90	90.07	91.24	0.0880	0.1542	0.2205
52300	89.73	90.93	92.13	0.0535	0.1029	0.1522
52300	91.14	92.33	93.52	0.0402	0.0864	0.1327
52300	92.11	93.31	94.51	0.0550	0.1104	0.1658
52300	93.09	94.27	95.45	0.0593	0.1153	0.1714
52300	94.09	95.24	96.39	0.0547	0.1080	0.1613
52300	95.03	96.23	97.43	0.0804	0.1426	0.2048
52300	95.79	96.99	98.19	0.0822	0.1431	0.2040
52300	96.63	97.88	99.13	0.1035	0.1721	0.2407
52300	97.53	98.76	99.99	0.1065	0.1742	0.2420
52300	98.41	99.62	100.83	0.0787	0.1403	0.2020
52300	99.26	100.53	101.80	0.0617	0.1179	0.1741
52300	100.19	101.45	102.71	0.0784	0.1376	0.1969
52300	101.35	102.58	103.81	0.0576	0.1125	0.1674
52300	102.66	103.87	105.08	0.0571	0.1160	0.1750
52300	103.47	104.68	105.89	0.0587	0.1136	0.1685
52300	104.36	105.60	106.84	0.0453	0.0966	0.1480
52300	105.49	106.76	108.03	0.0570	0.1078	0.1586
52300	106.49	107.74	108.99	0.0482	0.0953	0.1425
52300	107.55	108.78	110.01	0.0689	0.1270	0.1850
52300	108.36	109.59	110.82	0.0573	0.1125	0.1677
52300	109.25	110.48	111.71	0.0522	0.1017	0.1512
52300	110.38	111.65	112.92	0.0700	0.1304	0.1908
52300	111.40	112.63	113.86	0.0416	0.0866	0.1317
52300	112.57	113.80	115.03	0.0517	0.1055	0.1592
52300	113.57	114.77	115.97	0.0474	0.0976	0.1478
52300	114.82	116.02	117.22	0.0428	0.0941	0.1455
52300	115.76	116.92	118.08	0.0312	0.0744	0.1176
52300	116.74	117.90	119.06	0.0447	0.0997	0.1546
52300	117.83	118.98	120.13	0.0394	0.0896	0.1398
52300	118.76	119.95	121.14	0.0252	0.0648	0.1043
52300	119.84	121.04	122.24	0.0357	0.0847	0.1337
52300	120.71	121.89	123.07	0.0565	0.1088	0.1610
52300	121.72	122.89	124.06	0.0564	0.1128	0.1692
52300	122.86	124.05	125.24	0.0503	0.1021	0.1539
52300	123.79	125.00	126.21	0.0344	0.0797	0.1250
52300	124.79	126.00	127.21	0.0468	0.0980	0.1492
52300	125.69	126.89	128.09	0.0566	0.1108	0.1650
52300	126.53	127.73	128.93	0.0486	0.1053	0.1619
52300	127.74	128.99	130.24	0.0721	0.1344	0.1967
52300	128.57	129.83	131.09	0.0494	0.1049	0.1603

52300	129.58	130.85	132.12	0.0460	0.0947	0.1434
52300	130.60	131.93	133.26	0.0400	0.0826	0.1252
52300	131.51	132.87	134.23	0.0539	0.1044	0.1550
52300	132.41	133.72	135.03	0.0583	0.1135	0.1687
52300	133.27	134.59	135.91	0.0686	0.1266	0.1846
52300	134.03	135.34	136.65	0.0640	0.1157	0.1675
52300	135.07	136.35	137.63	0.0476	0.0986	0.1496
52300	136.16	137.46	138.76	0.0276	0.0681	0.1087
52300	137.04	138.31	139.58	0.0246	0.0707	0.1167
52300	138.12	139.38	140.64	0.0526	0.1043	0.1560
52300	138.95	140.24	141.53	0.0489	0.1036	0.1584
52300	140.04	141.36	142.68	0.0311	0.0793	0.1276
52300	140.95	142.25	143.55	0.0427	0.0942	0.1456
52300	141.89	143.18	144.47	0.0295	0.0785	0.1276
52300	142.73	144.00	145.27	0.0345	0.0793	0.1242
52300	143.60	144.85	146.10	0.0206	0.0675	0.1143
52300	144.46	145.68	146.90	0.0180	0.0556	0.0932
52300	145.44	146.67	147.90	0.0409	0.0916	0.1422
52300	146.33	147.51	148.69	0.0186	0.0551	0.0916
52300	147.39	148.57	149.75	0.0417	0.0925	0.1433
52300	148.37	149.53	150.69	0.0294	0.0749	0.1205
52300	149.49	150.62	151.75	0.0244	0.0683	0.1122
52300	150.47	151.63	152.79	0.0123	0.0490	0.0857
52300	151.44	152.62	153.80	0.0025	0.0316	0.0607
52300	152.41	153.60	154.79	0.0195	0.0599	0.1003
52300	153.49	154.71	155.93	0.0456	0.0944	0.1431
52300	154.61	155.85	157.09	0.0557	0.1097	0.1637
52300	155.62	156.83	158.04	0.0455	0.0995	0.1534
52300	156.40	157.62	158.84	0.0520	0.1076	0.1633
52300	157.26	158.49	159.72	0.0373	0.0908	0.1442
52300	158.27	159.53	160.79	0.0146	0.0529	0.0913
52300	159.32	160.56	161.80	0.0375	0.0842	0.1309
52300	160.21	161.47	162.73	0.0419	0.0902	0.1385
52300	161.40	162.66	163.92	0.0115	0.0474	0.0832
52300	162.32	163.61	164.90	0.0275	0.0724	0.1173
52300	163.30	164.63	165.96	0.0659	0.1232	0.1804
52300	164.39	165.70	167.01	0.0611	0.1170	0.1729
52300	165.42	166.76	168.10	0.0703	0.1333	0.1963
52300	166.26	167.59	168.92	0.0659	0.1243	0.1827
52300	167.23	168.56	169.89	0.0689	0.1258	0.1827
52300	168.41	169.73	171.05	0.0441	0.0953	0.1466
52300	169.48	170.82	172.16	0.0338	0.0802	0.1266
52300	170.33	171.65	172.97	0.0325	0.0776	0.1227
52300	171.60	172.87	174.14	0.0414	0.0944	0.1474
52300	172.58	173.87	175.16	0.0225	0.0656	0.1087
52300	173.89	175.13	176.37	0.0453	0.0962	0.1472
52300	175.27	176.49	177.71	0.0318	0.0683	0.1048
52300	176.13	177.36	178.59	0.0431	0.0924	0.1417
52300	177.11	178.31	179.51	0.0428	0.0914	0.1400
52300	178.23	179.43	180.63	0.0468	0.0995	0.1522
52300	178.99	180.18	181.37	0.0388	0.0900	0.1411
52300	180.18	181.37	182.56	0.0398	0.0854	0.1310
52300	181.18	182.37	183.56	0.0376	0.0902	0.1428
52300	182.36	183.52	184.68	0.0300	0.0786	0.1272
52300	183.45	184.58	185.71	0.0223	0.0565	0.0908
52300	184.50	185.60	186.70	0.0354	0.0854	0.1355

52300	185.45	186.59	187.73	0.0312	0.0787	0.1262
52300	186.64	187.77	188.90	0.0377	0.0802	0.1227
52300	187.48	188.61	189.74	0.0262	0.0713	0.1163
52300	188.51	189.66	190.81	0.0285	0.0716	0.1148
52300	189.37	190.52	191.67	0.0513	0.1055	0.1596
52300	190.41	191.55	192.69	0.0743	0.1369	0.1995
52300	191.29	192.45	193.61	0.0821	0.1455	0.2090
52300	192.08	193.23	194.38	0.0844	0.1524	0.2204
52300	193.14	194.27	195.40	0.0624	0.1206	0.1789
52300	193.85	194.98	196.11	0.0450	0.0948	0.1445
52300	194.96	196.08	197.20	0.0401	0.0876	0.1350
52300	196.02	197.14	198.26	0.0201	0.0622	0.1043
52300	196.98	198.12	199.26	0.0133	0.0464	0.0795
52300	197.88	199.02	200.16	0.0204	0.0634	0.1065
52300	198.67	199.83	200.99	0.0161	0.0604	0.1046
52300	199.80	200.97	202.14	0.0075	0.0438	0.0801
52300	201.13	202.28	203.43	0.0146	0.0551	0.0956
52300	202.22	203.35	204.48	0.0283	0.0740	0.1198
52300	203.23	204.37	205.51	0.0309	0.0767	0.1224
52300	204.17	205.31	206.45	0.0354	0.0777	0.1201
52300	205.35	206.49	207.63	0.0246	0.0691	0.1136
52300	206.60	207.73	208.86	0.0246	0.0642	0.1038
52300	207.75	208.92	210.09	0.0091	0.0432	0.0774
52300	208.61	209.79	210.97	0.0399	0.0902	0.1404
52300	209.78	210.90	212.02	0.0413	0.0931	0.1449
52300	210.69	211.82	212.95	0.0519	0.1055	0.1591
52300	211.76	212.84	213.92	0.0322	0.0778	0.1235
52300	212.94	214.04	215.14	0.0402	0.0908	0.1413
52300	213.97	215.09	216.21	0.0421	0.0855	0.1290
52300	215.07	216.20	217.33	0.0422	0.0906	0.1390
52300	215.97	217.11	218.25	0.0706	0.1302	0.1898
52300	216.97	218.11	219.25	0.0656	0.1190	0.1724
52300	217.80	218.99	220.18	0.0415	0.0922	0.1429
52300	218.93	220.12	221.31	0.0602	0.1155	0.1708
52300	219.85	221.04	222.23	0.0545	0.1088	0.1631
52300	220.75	221.94	223.13	0.0242	0.0672	0.1102
52300	221.64	222.81	223.98	0.0418	0.0933	0.1448
52300	222.54	223.72	224.90	0.0428	0.0930	0.1432
52300	223.50	224.70	225.90	0.0236	0.0699	0.1163
52300	224.82	226.02	227.22	0.0264	0.0644	0.1024
52300	225.82	227.02	228.22	0.0275	0.0654	0.1032
52300	226.86	228.08	229.30	0.0161	0.0582	0.1003
52300	227.73	228.96	230.19	0.0234	0.0666	0.1099
52300	228.82	230.04	231.26	0.0230	0.0622	0.1014
52300	229.97	231.21	232.45	0.0326	0.0829	0.1333
52300	230.72	232.00	233.28	0.0365	0.0853	0.1342
52300	231.46	232.73	234.00	0.0491	0.0985	0.1480
52300	232.45	233.71	234.97	0.0584	0.1126	0.1667
52300	233.11	234.41	235.71	0.0459	0.1002	0.1545
52300	233.99	235.29	236.59	0.0374	0.0886	0.1397
52300	235.03	236.35	237.67	0.0515	0.1078	0.1642
52300	236.02	237.35	238.68	0.0526	0.1042	0.1558
52300	237.24	238.55	239.86	0.0656	0.1244	0.1832
52300	238.36	239.68	241.00	0.0551	0.1071	0.1591
52300	239.45	240.82	242.19	0.0430	0.0917	0.1404
52300	240.51	241.91	243.31	0.0593	0.1127	0.1661

52300	241.66	243.09	244.52	0.0453	0.0959	0.1465
52300	242.76	244.23	245.70	0.0304	0.0716	0.1128
52300	244.12	245.56	247.00	0.0601	0.1151	0.1701
52300	245.23	246.62	248.01	0.0541	0.1091	0.1641
52300	246.22	247.62	249.02	0.0864	0.1494	0.2125
52300	247.52	248.93	250.34	0.0745	0.1331	0.1917
52300	248.43	249.84	251.25	0.0688	0.1284	0.1880
52300	249.45	250.82	252.19	0.0640	0.1254	0.1869
52300	250.61	252.00	253.39	0.0586	0.1131	0.1677
52300	251.62	253.03	254.44	0.0644	0.1218	0.1792
52300	252.69	254.08	255.47	0.0993	0.1636	0.2279
52300	253.67	255.07	256.47	0.0677	0.1244	0.1811
52300	254.62	256.01	257.40	0.0841	0.1431	0.2022
52300	255.53	256.95	258.37	0.0889	0.1524	0.2160
52300	256.65	258.07	259.49	0.0902	0.1527	0.2152
52300	257.60	259.03	260.45	0.0839	0.1499	0.2158
52300	258.75	260.19	261.63	0.0616	0.1136	0.1655
52300	259.73	261.17	262.61	0.0791	0.1370	0.1948
52300	260.74	262.17	263.60	0.1007	0.1688	0.2368
52300	261.68	263.09	264.50	0.1327	0.2049	0.2770
52300	262.86	264.24	265.62	0.0921	0.1558	0.2195
52300	263.93	265.30	266.67	0.0586	0.1142	0.1698
52300	264.93	266.27	267.61	0.0735	0.1321	0.1907
52300	265.59	266.96	268.33	0.1046	0.1747	0.2448
52300	266.85	268.20	269.55	0.1004	0.1633	0.2261
52300	267.67	268.99	270.31	0.1070	0.1729	0.2387
52300	268.64	270.00	271.36	0.0975	0.1627	0.2280
52300	269.58	270.96	272.34	0.0761	0.1342	0.1922
52300	270.53	271.90	273.27	0.0783	0.1333	0.1883
52300	271.57	272.95	274.32	0.0815	0.1417	0.2020
52300	272.54	273.91	275.28	0.0835	0.1430	0.2025
52300	273.68	275.04	276.40	0.0643	0.1232	0.1821
52300	274.56	275.94	277.32	0.0656	0.1247	0.1838
52300	275.79	277.18	278.57	0.0678	0.1256	0.1834
52300	276.54	277.94	279.34	0.1058	0.1686	0.2315
52300	277.51	278.95	280.39	0.1031	0.1652	0.2273
52300	278.50	279.94	281.38	0.0708	0.1266	0.1825
52300	279.54	280.97	282.40	0.1030	0.1705	0.2381
52300	280.63	282.05	283.47	0.1003	0.1665	0.2328
52300	281.47	282.85	284.23	0.0849	0.1473	0.2096
52300	282.45	283.84	285.23	0.0803	0.1390	0.1977
52300	283.60	284.98	286.36	0.0790	0.1374	0.1958
52300	284.87	286.25	287.59	0.0834	0.1438	0.2042
52300	285.72	287.08	288.44	0.0498	0.0990	0.1482
52300	286.88	288.23	289.58	0.0721	0.1307	0.1894
52300	287.99	289.34	290.69	0.0873	0.1515	0.2158
52300	289.01	290.37	291.73	0.0870	0.1506	0.2141
52300	289.88	291.24	292.60	0.0968	0.1610	0.2251
52300	290.80	292.14	293.48	0.0899	0.1537	0.2175
52300	292.02	293.37	294.72	0.0483	0.0975	0.1467
52300	292.96	294.27	295.58	0.0486	0.1040	0.1595
52300	293.87	295.22	296.57	0.0659	0.1269	0.1879
52300	294.61	295.99	297.37	0.0655	0.1163	0.1671
52300	295.76	297.13	298.50	0.0692	0.1255	0.1818
52300	296.81	298.21	299.61	0.0745	0.1381	0.2016
52300	297.74	299.14	300.54	0.0735	0.1252	0.1768

52300	298.90	300.28	301.66	0.0887	0.1521	0.2155
52300	300.01	301.38	302.75	0.0700	0.1306	0.1911
52300	300.97	302.33	303.69	0.0850	0.1502	0.2155
52300	301.85	303.20	304.55	0.0664	0.1215	0.1765
52300	302.92	304.27	305.62	0.0698	0.1260	0.1823
52300	303.93	305.27	306.61	0.0720	0.1325	0.1930
52300	304.81	306.18	307.55	0.0564	0.1114	0.1663
52300	305.76	307.14	308.52	0.0722	0.1277	0.1831
52300	306.93	308.31	309.68	0.0442	0.0922	0.1403
52300	307.96	309.40	310.83	0.0352	0.0831	0.1310
52300	308.95	310.38	311.81	0.0813	0.1417	0.2022
52300	309.93	311.37	312.81	0.0843	0.1479	0.2116
52300	310.87	312.31	313.75	0.1062	0.1736	0.2410
52300	311.62	313.02	314.42	0.1003	0.1634	0.2265
52300	312.64	314.03	315.42	-0.0810	0.1398	0.1987
52300	313.68	315.07	316.46	0.0961	0.1587	0.2213
52300	314.84	316.19	317.54	0.1036	0.1716	0.2396
52300	315.86	317.18	318.49	0.0937	0.1577	0.2218
52300	316.86	318.19	319.52	0.0830	0.1436	0.2042
52300	317.94	319.23	320.52	0.0775	0.1375	0.1975
52300	319.06	320.35	321.64	0.0641	0.1187	0.1734
52300	320.20	321.48	322.76	0.0830	0.1426	0.2022
52300	321.06	322.35	323.64	0.0559	0.1069	0.1580
52300	322.23	323.51	324.79	0.0409	0.0924	0.1440
52300	323.05	324.36	325.67	0.0369	0.0859	0.1350
52300	324.18	325.54	326.90	0.0432	0.0902	0.1373
52300	325.30	326.62	327.93	0.0588	0.1067	0.1546
52300	326.25	327.60	328.95	0.0654	0.1226	0.1798
52300	327.14	328.50	329.86	0.0952	0.1558	0.2164
52300	328.09	329.48	330.87	0.0562	0.1122	0.1682
52300	329.01	330.43	331.85	0.0558	0.1097	0.1637
52300	330.17	331.57	332.97	0.0673	0.1216	0.1759
52300	331.01	332.47	333.93	0.0729	0.1285	0.1840
52300	332.24	333.67	335.10	0.0510	0.1031	0.1553
52300	333.27	334.69	336.11	0.0778	0.1399	0.2019
52300	334.18	335.58	336.98	0.0651	0.1205	0.1759
52300	335.01	336.40	337.79	0.0238	0.0655	0.1072
52300	336.05	337.40	338.75	0.0312	0.0773	0.1234
52300	336.98	338.31	339.63	0.0479	0.0997	0.1515
52300	338.00	339.31	340.62	0.0448	0.0946	0.1444
52300	338.85	340.16	341.47	0.0446	0.0959	0.1471
52300	339.83	341.12	342.41	0.0479	0.0994	0.1509
52300	340.75	342.07	343.39	0.0434	0.0887	0.1340
52300	341.54	342.86	344.18	0.0357	0.0835	0.1312
52300	342.69	344.01	345.33	0.0612	0.1137	0.1662
52300	343.92	345.19	346.46	0.0766	0.1389	0.2012
52300	345.07	346.35	347.63	0.0488	0.0988	0.1488
52300	346.11	347.42	348.73	0.0456	0.0926	0.1396
52300	347.28	348.59	349.90	0.0711	0.1251	0.1791
52300	348.25	349.54	350.83	0.0273	0.0684	0.1096
52300	349.09	350.37	351.65	0.0420	0.0951	0.1482
52300	350.05	351.37	352.69	0.0707	0.1282	0.1858
52300	350.94	352.25	353.56	0.0544	0.1093	0.1643
52300	351.84	353.12	354.40	0.0486	0.1003	0.1520
52300	352.86	354.16	355.46	0.0355	0.0812	0.1269
52300	354.00	355.28	356.56	0.0424	0.0921	0.1418

52300	355.04	356.31	357.58	0.0404	0.0917	0.1431
52300	355.77	357.06	358.35	0.0447	0.0941	0.1435
52300	356.73	358.02	359.31	0.0613	0.1166	0.1718
52300	357.76	359.05	360.34	0.0573	0.1152	0.1730
52300	358.68	360.03	361.38	0.0513	0.1088	0.1663
52300	359.71	361.12	362.53	0.0683	0.1287	0.1891
52300	360.51	361.94	363.37	0.0643	0.1221	0.1799
52300	361.40	362.82	364.24	0.0570	0.1122	0.1674
52300	362.40	363.78	365.16	0.0674	0.1261	0.1848
52300	363.67	365.03	366.39	0.0323	0.0816	0.1309
52300	364.64	366.03	367.42	0.0645	0.1171	0.1698
52300	365.48	366.85	368.22	0.0389	0.0867	0.1344
52300	366.52	367.89	369.26	0.0413	0.0896	0.1378
52300	367.35	368.71	370.07	0.0509	0.1058	0.1607
52300	368.42	369.73	371.04	0.0353	0.0801	0.1250
52300	369.65	370.97	372.29	0.0429	0.0953	0.1478
52300	370.63	371.93	373.23	0.0364	0.0853	0.1343
52300	371.49	372.80	374.11	0.0283	0.0769	0.1255
52300	372.42	373.73	375.04	0.0449	0.0968	0.1487
52300	373.36	374.67	375.98	0.0599	0.1167	0.1735
52300	374.37	375.68	376.99	0.0727	0.1313	0.1898
52300	375.44	376.75	378.06	0.0482	0.0955	0.1428
52300	376.43	377.73	379.03	0.0429	0.0948	0.1467
52300	377.48	378.85	380.22	0.0686	0.1267	0.1849
52300	378.49	379.82	381.15	0.0622	0.1197	0.1772
52300	379.56	380.88	382.20	0.0296	0.0729	0.1161
52300	380.49	381.79	383.09	0.0340	0.0811	0.1281
52300	381.29	382.55	383.80	0.0356	0.0857	0.1358
52300	382.29	383.56	384.83	0.0463	0.1010	0.1557
52300	383.44	384.73	386.01	0.0511	0.1014	0.1517
52300	384.44	385.74	387.04	0.0516	0.1033	0.1549
52300	385.41	386.70	387.99	0.0454	0.0977	0.1500
52300	386.34	387.63	388.92	0.0558	0.1132	0.1706
52300	387.37	388.66	389.95	0.0774	0.1415	0.2057
52300	388.29	389.58	390.87	0.0494	0.1009	0.1524
52300	389.19	390.50	391.81	0.0567	0.1116	0.1666
52300	390.07	391.37	392.67	0.0632	0.1189	0.1746
52300	391.09	392.38	393.67	0.0650	0.1240	0.1830
52300	392.15	393.45	394.75	0.0691	0.1257	0.1823
52300	393.02	394.33	395.64	0.0406	0.0926	0.1447
52300	394.05	395.39	396.73	0.0392	0.0868	0.1344
52300	394.95	396.30	397.65	0.0653	0.1220	0.1787
52300	395.95	397.29	398.63	0.0508	0.1018	0.1528
52300	396.76	398.10	399.44	0.0285	0.0697	0.1109
52300	397.77	399.08	400.39	0.0187	0.0641	0.1094
52300	398.80	400.10	401.40	0.0339	0.0781	0.1223
52300	399.92	401.27	402.62	0.0550	0.1111	0.1672
52300	400.80	402.16	403.52	0.0483	0.1025	0.1568
52300	401.85	403.22	404.59	0.0448	0.0950	0.1453
52300	402.85	404.23	405.61	0.0529	0.1086	0.1644
52300	403.70	405.12	406.54	0.0337	0.0788	0.1239
52300	404.67	406.09	407.50	0.0457	0.0944	0.1431
52300	405.61	407.02	408.43	0.0498	0.1016	0.1533
52300	406.53	407.94	409.35	0.0249	0.0674	0.1099
52300	407.68	409.09	410.50	0.0341	0.0832	0.1322
52300	408.79	410.14	411.49	0.0500	0.0968	0.1436

52300	409.78	411.07	412.36	0.0668	0.1223	0.1778
52300	410.63	411.96	413.29	0.0622	0.1202	0.1781
52300	411.33	412.66	413.99	0.0650	0.1241	0.1831
52300	412.29	413.59	414.89	0.0702	0.1318	0.1933
52300	413.23	414.52	415.80	0.0538	0.1070	0.1603
52300	414.28	415.57	416.86	0.0662	0.1255	0.1848
52300	415.24	416.62	418.00	0.0452	0.0992	0.1533
52300	416.21	417.60	418.99	0.0430	0.0894	0.1358
52300	417.46	418.88	420.30	0.0309	0.0722	0.1135
52300	418.19	419.62	421.05	0.0494	0.1018	0.1541
52300	419.36	420.77	422.17	0.0608	0.1167	0.1725
52300	420.40	421.83	423.25	0.0502	0.1020	0.1539
52300	421.47	422.86	424.25	0.0403	0.0921	0.1439
52300	422.39	423.81	425.23	0.0305	0.0792	0.1280
52300	423.50	424.91	426.32	0.0519	0.1076	0.1634
52300	424.41	425.80	427.19	0.0819	0.1472	0.2124
52300	425.58	426.93	428.28	0.0812	0.1427	0.2041
52300	426.66	427.99	429.32	0.0769	0.1373	0.1977
52300	427.68	429.03	430.38	0.0788	0.1404	0.2020
52300	428.50	429.85	431.20	0.0645	0.1212	0.1779
52300	429.46	430.82	432.18	0.0547	0.1118	0.1688
52300	430.45	431.82	433.19	0.0432	0.0958	0.1484
52300	431.56	432.95	434.34	0.0727	0.1346	0.1965
52300	432.62	433.98	435.34	0.0853	0.1480	0.2107
52300	433.73	435.10	436.47	0.0951	0.1592	0.2233
52300	434.73	436.12	437.51	0.0642	0.1209	0.1775
52300	435.68	437.09	438.50	0.0582	0.1170	0.1758
52300	436.74	438.16	439.58	0.0815	0.1433	0.2051
52300	437.64	439.04	440.44	0.0706	0.1321	0.1937
52300	438.70	440.08	441.46	0.0537	0.1117	0.1696
52300	439.90	441.22	442.54	0.0308	0.0771	0.1235
52300	440.98	442.30	443.62	0.0269	0.0699	0.1130
52300	442.01	443.33	444.65	0.0327	0.0804	0.1282
52300	443.01	444.33	445.65	0.0583	0.1133	0.1683
52300	444.22	445.48	446.74	0.0583	0.1154	0.1724
52300	444.95	446.20	447.45	0.0407	0.0896	0.1385
52300	446.12	447.34	448.56	0.0424	0.0938	0.1452
52300	447.25	448.46	449.67	0.0292	0.0705	0.1117
52300	448.37	449.57	450.77	0.0378	0.0828	0.1279
52300	449.42	450.63	451.83	0.0515	0.1071	0.1626
52300	450.56	451.73	452.90	0.0281	0.0717	0.1154
52300	451.63	452.77	453.91	0.0534	0.1067	0.1600
52300	452.69	453.78	454.87	0.0853	0.1489	0.2125
52300	453.59	454.69	455.79	0.0524	0.1045	0.1566
52300	454.68	455.78	456.88	0.0535	0.1040	0.1546
52300	455.82	456.91	458.00	0.0601	0.1105	0.1608
52300	456.97	458.09	459.21	0.0548	0.1056	0.1565
52300	457.69	458.85	460.01	0.0513	0.1055	0.1597
52300	458.84	460.01	461.17	0.0565	0.1103	0.1641
52300	459.64	460.78	461.92	0.0615	0.1160	0.1705
52300	460.49	461.64	462.79	0.0844	0.1458	0.2072
52300	461.36	462.53	463.70	0.0826	0.1477	0.2129
52300	462.44	463.62	464.80	0.0731	0.1341	0.1952
52300	463.15	464.31	465.47	0.0648	0.1176	0.1705
52300	464.15	465.27	466.39	0.0230	0.0665	0.1101
52300	465.07	466.19	467.31	0.0466	0.0922	0.1379

52300	466.04	467.16	468.28	0.0281	0.0734	0.1188
52300	467.10	468.19	469.28	0.0230	0.0637	0.1043
52300	468.02	469.09	470.16	0.0199	0.0580	0.0962
52300	469.22	470.35	471.48	0.0295	0.0761	0.1227
52300	470.32	471.51	472.70	0.0440	0.1008	0.1576
52300	471.40	472.68	473.96	0.0579	0.1113	0.1646
52300	472.69	473.98	475.27	0.0477	0.0982	0.1487
52300	474.14	475.38	476.62	0.0551	0.1051	0.1552
52300	475.17	476.40	477.63	0.0280	0.0635	0.0991
52300	476.12	477.34	478.56	0.0435	0.0920	0.1404
52300	477.02	478.24	479.46	0.0355	0.0823	0.1291
52300	478.05	479.31	480.57	0.0307	0.0735	0.1162
52300	478.94	480.18	481.42	0.0521	0.1025	0.1529
52300	479.84	481.05	482.26	0.0627	0.1152	0.1677
52300	481.07	482.24	483.41	0.0538	0.1080	0.1622
52300	481.99	483.14	484.29	0.0349	0.0818	0.1287
52300	482.91	484.08	485.25	0.0391	0.0871	0.1351
52300	483.84	485.02	486.20	0.0668	0.1247	0.1826
52300	485.01	486.15	487.29	0.0779	0.1410	0.2041
52300	485.86	487.00	488.14	0.0760	0.1349	0.1938
52300	486.78	487.90	489.02	0.0746	0.1286	0.1826
52300	487.88	489.02	490.16	0.0267	0.0640	0.1014
52300	488.94	490.07	491.20	0.0153	0.0528	0.0903
52300	489.91	491.05	492.19	0.0032	0.0340	0.0648
52300	490.77	491.90	493.03	0.0115	0.0438	0.0760
52300	491.76	492.89	494.02	0.0263	0.0672	0.1082
52300	492.65	493.75	494.85	0.0357	0.0853	0.1349
52300	493.48	494.59	495.70	0.0148	0.0500	0.0852
52300	494.47	495.58	496.69	0.0259	0.0713	0.1166
52300	495.32	496.45	497.58	0.0114	0.0516	0.0918
52300	496.36	497.51	498.66	0.0272	0.0692	0.1112
52300	497.38	498.53	499.68	0.0365	0.0853	0.1340
52300	498.31	499.47	500.63	0.0363	0.0889	0.1415
52300	499.30	500.47	501.64	0.0256	0.0686	0.1117

LN	ARRIVING		CAP		HOL			COM		
give	21.73	0	0	0	0	0	0	0	0	0
52300	21.74	2.54	3.04	3.54	19.22	20.72	22.22	22.08	23.76	25.44
52300	25.09	3.09	3.71	4.33	23.15	24.61	26.07	26.62	28.32	30.02
52300	27.67	3.24	3.95	4.67	26.08	27.71	29.34	29.71	31.66	33.61
52300	30.26	2.82	3.48	4.15	26.65	28.31	29.98	29.83	31.80	33.76
52300	32.56	3.29	4.04	4.79	27.87	29.61	31.36	31.65	33.65	35.65
52300	34.55	3.55	4.37	5.20	30.10	31.89	33.68	34.10	36.27	38.43
52300	36.60	3.45	4.28	5.11	30.06	32.03	34.00	33.98	36.32	38.65
52300	37.98	3.54	4.27	5.01	29.87	31.56	33.24	33.95	35.83	37.71
52300	39.62	3.35	4.11	4.88	29.86	31.88	33.91	33.67	36.00	38.33
52300	41.28	3.81	4.73	5.64	34.36	36.41	38.45	38.90	41.13	43.36
52300	42.52	3.75	4.58	5.40	32.55	34.75	36.94	36.83	39.33	41.82
52300	44.13	3.59	4.27	4.94	32.29	34.43	36.57	36.45	38.70	40.95
52300	45.50	3.67	4.62	5.57	33.24	35.18	37.12	37.48	39.80	42.12
52300	47.14	3.20	4.03	4.86	32.73	34.85	36.97	36.44	38.88	41.31
52300	48.32	3.29	4.10	4.91	34.49	36.50	38.51	38.21	40.60	42.99
52300	49.91	4.71	5.77	6.84	34.67	36.88	39.10	40.00	42.66	45.31
52300	50.89	3.40	4.16	4.91	34.48	36.73	38.98	38.43	40.88	43.34
52300	52.10	3.28	4.14	5.01	32.08	34.12	36.16	35.85	38.26	40.68

52300	53.15	3.55	4.46	5.38	34.46	36.76	39.06	38.78	41.23	43.68
52300	54.22	4.45	5.64	6.84	35.96	38.52	41.08	41.03	44.17	47.30
52300	55.32	3.45	4.43	5.41	32.91	35.10	37.29	36.96	39.53	42.10
52300	56.30	4.72	5.87	7.02	36.22	38.37	40.52	41.58	44.24	46.90
52300	57.55	4.61	5.64	6.66	33.32	35.48	37.64	38.47	41.12	43.76
52300	58.44	3.12	3.96	4.80	36.46	38.94	41.41	40.13	42.89	45.66
52300	59.80	4.12	5.09	6.07	36.53	38.94	41.36	41.20	44.03	46.87
52300	60.68	3.96	5.14	6.31	35.69	37.85	40.01	40.42	42.98	45.55
52300	61.87	3.46	4.32	5.18	33.92	36.43	38.93	37.99	40.74	43.50
52300	63.11	4.58	5.62	6.65	34.56	36.90	39.25	39.78	42.52	45.26
52300	64.33	4.24	5.11	5.98	37.62	40.11	42.61	42.39	45.22	48.05
52300	65.67	3.87	4.86	5.85	34.65	36.92	39.18	39.03	41.78	44.52
52300	66.48	3.72	4.76	5.80	35.09	37.53	39.96	39.56	42.28	45.00
52300	67.67	4.65	5.80	6.94	35.31	37.85	40.38	40.76	43.64	46.52
52300	68.69	4.20	5.08	5.95	37.08	39.57	42.06	41.82	44.65	47.48
52300	69.51	3.64	4.68	5.72	32.26	34.49	36.73	36.57	39.17	41.77
52300	70.61	4.12	5.32	6.52	35.49	37.77	40.05	40.25	43.09	45.94
52300	71.51	4.49	5.57	6.66	37.22	39.88	42.55	42.42	45.46	48.49
52300	72.79	4.15	5.16	6.18	34.79	37.47	40.15	39.44	42.64	45.83
52300	73.56	4.44	5.70	6.96	35.60	38.06	40.52	40.74	43.76	46.78
52300	74.42	3.68	4.76	5.85	34.57	36.97	39.38	38.78	41.74	44.69
52300	75.38	3.99	5.05	6.10	35.72	38.12	40.53	40.29	43.17	46.05
52300	76.39	4.66	5.94	7.22	36.54	38.91	41.28	41.74	44.86	47.98
52300	77.28	4.32	5.61	6.91	36.68	39.30	41.92	41.53	44.91	48.29
52300	78.40	3.72	4.83	5.94	35.11	37.62	40.14	39.43	42.46	45.49
52300	79.57	4.70	5.96	7.23	37.05	39.36	41.66	42.43	45.32	48.21
52300	80.58	4.30	5.42	6.55	36.90	39.64	42.38	41.69	45.06	48.43
52300	81.72	4.64	6.25	7.87	38.37	41.15	43.92	43.69	47.40	51.11
52300	82.82	3.89	5.07	6.25	36.94	39.19	41.44	41.41	44.26	47.11
52300	83.89	4.57	5.91	7.25	35.69	38.41	41.13	40.97	44.32	47.66
52300	84.85	4.83	6.15	7.46	36.28	38.79	41.30	41.88	44.94	47.99
52300	85.89	4.66	5.56	6.46	35.68	38.04	40.40	40.83	43.60	46.38
52300	86.72	4.57	5.68	6.80	36.80	39.24	41.68	41.97	44.92	47.87
52300	87.79	4.63	6.22	7.82	35.99	38.54	41.08	41.23	44.76	48.29
52300	88.91	4.89	5.96	7.02	36.47	38.95	41.43	41.94	44.90	47.87
52300	90.07	3.61	4.55	5.48	35.64	38.28	40.91	39.92	42.82	45.73
52300	90.93	4.45	5.54	6.63	39.63	42.07	44.51	44.64	47.61	50.59
52300	92.33	5.51	6.83	8.15	38.83	41.78	44.73	45.02	48.61	52.19
52300	93.31	4.63	6.12	7.62	35.52	38.48	41.44	40.69	44.60	48.51
52300	94.27	3.94	5.26	6.58	36.85	39.27	41.70	41.54	44.54	47.53
52300	95.24	4.58	6.08	7.57	35.30	38.26	41.23	40.66	44.34	48.01
52300	96.23	4.89	6.18	7.47	36.12	38.84	41.56	41.65	45.02	48.40
52300	96.99	4.06	5.64	7.23	38.32	41.02	43.71	43.05	46.66	50.27
52300	97.88	4.78	6.72	8.66	39.86	43.11	46.36	45.44	49.83	54.22
52300	98.76	4.62	6.12	7.62	38.26	40.92	43.57	43.43	47.04	50.65
52300	99.62	4.93	6.38	7.84	37.75	40.38	43.02	43.41	46.77	50.12
52300	100.53	4.47	5.68	6.88	37.78	40.68	43.57	42.79	46.36	49.92
52300	101.45	5.21	6.54	7.87	38.75	41.74	44.74	44.54	48.29	52.04
52300	102.58	4.54	5.69	6.84	36.41	38.82	41.24	41.58	44.51	47.45
52300	103.87	5.23	6.61	8.00	37.95	40.99	44.03	43.77	47.61	51.44
52300	104.68	4.56	5.81	7.06	35.23	37.85	40.46	40.43	43.66	46.89
52300	105.60	4.36	5.26	6.17	34.83	37.17	39.50	39.78	42.43	45.08
52300	106.76	5.18	6.43	7.68	36.58	39.14	41.70	42.31	45.57	48.83
52300	107.74	5.02	6.07	7.11	37.51	39.94	42.37	43.09	46.01	48.93
52300	108.78	5.08	6.42	7.76	37.68	40.20	42.71	43.44	46.62	49.79
52300	109.59	4.67	5.85	7.03	39.16	42.04	44.92	44.54	47.89	51.23

52300	110.48	5.01	6.13	7.25	39.07	41.59	44.11	44.63	47.72	50.81
52300	111.65	3.68	4.52	5.37	37.41	39.99	42.56	41.65	44.51	47.37
52300	112.63	5.02	6.34	7.66	36.55	39.05	41.56	42.19	45.39	48.60
52300	113.80	4.55	5.71	6.88	37.20	40.20	43.20	42.27	45.91	49.56
52300	114.77	4.39	5.69	6.98	36.04	38.82	41.60	41.05	44.51	47.97
52300	116.02	4.10	5.46	6.82	36.58	39.38	42.17	41.32	44.84	48.35
52300	116.92	3.97	5.31	6.64	35.57	38.28	40.99	39.99	43.59	47.19
52300	117.90	4.56	5.81	7.06	34.59	37.10	39.60	39.79	42.90	46.02
52300	118.98	3.75	4.82	5.89	36.53	38.95	41.37	40.97	43.77	46.57
52300	119.95	5.08	6.64	8.21	36.54	39.35	42.15	42.13	45.99	49.85
52300	121.04	4.04	5.41	6.79	35.40	37.53	39.67	39.88	42.95	46.02
52300	121.89	4.69	6.06	7.42	34.83	37.45	40.07	40.08	43.51	46.94
52300	122.89	5.00	6.74	8.48	37.98	40.92	43.86	43.54	47.66	51.78
52300	124.05	5.19	6.65	8.11	37.15	39.83	42.50	42.89	46.48	50.06
52300	125.00	4.57	5.91	7.26	36.41	39.18	41.96	41.48	45.10	48.71
52300	126.00	4.80	5.96	7.13	36.82	39.51	42.19	42.26	45.47	48.68
52300	126.89	4.85	6.61	8.38	35.88	38.74	41.59	41.27	45.35	49.43
52300	127.73	4.88	6.26	7.64	39.32	42.13	44.94	44.82	48.39	51.96
52300	128.99	5.41	7.01	8.62	36.34	38.82	41.31	42.42	45.84	49.26
52300	129.83	5.04	6.50	7.97	37.57	40.47	43.38	43.23	46.97	50.71
52300	130.85	5.19	6.48	7.76	36.03	38.93	41.82	41.90	45.40	48.91
52300	131.93	4.84	6.17	7.51	37.64	40.45	43.26	43.17	46.62	50.07
52300	132.87	5.42	6.77	8.12	38.20	41.27	44.34	44.37	48.04	51.71
52300	133.72	4.68	6.50	8.31	37.40	40.08	42.77	42.74	46.58	50.42
52300	134.59	4.83	6.24	7.65	38.15	41.13	44.10	43.67	47.37	51.07
52300	135.34	5.11	6.42	7.72	40.05	43.02	46.00	45.63	49.44	53.25
52300	136.35	5.31	7.05	8.79	36.47	39.76	43.05	42.42	46.81	51.20
52300	137.46	4.77	5.95	7.13	37.13	40.04	42.94	42.52	45.99	49.45
52300	138.31	4.21	5.76	7.32	36.87	39.51	42.16	41.87	45.28	48.69
52300	139.38	5.51	7.01	8.51	36.23	38.78	41.32	42.30	45.78	49.27
52300	140.24	4.93	6.11	7.30	37.54	40.07	42.60	43.05	46.18	49.31
52300	141.36	4.81	5.95	7.09	35.38	37.90	40.42	40.76	43.85	46.94
52300	142.25	4.65	6.02	7.38	35.71	38.22	40.74	41.09	44.24	47.39
52300	143.18	5.97	7.33	8.69	38.64	41.27	43.91	45.21	48.60	52.00
52300	144.00	4.24	5.43	6.62	35.92	38.71	41.51	40.72	44.14	47.56
52300	144.85	3.53	4.71	5.88	38.39	41.15	43.91	42.60	45.86	49.11
52300	145.68	4.44	5.69	6.93	39.07	41.66	44.24	44.20	47.34	50.49
52300	146.67	4.66	6.27	7.87	38.78	41.74	44.70	44.08	48.01	51.93
52300	147.51	4.75	5.87	6.99	38.21	40.98	43.74	43.71	46.84	49.97
52300	148.57	5.20	6.44	7.69	37.59	40.39	43.20	43.51	46.84	50.16
52300	149.53	4.53	5.64	6.76	39.08	41.88	44.68	44.30	47.52	50.74
52300	150.62	5.24	6.47	7.69	35.97	38.73	41.49	41.80	45.19	48.59
52300	151.63	4.76	6.07	7.37	37.36	39.81	42.26	42.77	45.88	48.99
52300	152.62	5.02	6.68	8.33	37.23	40.19	43.15	42.97	46.87	50.77
52300	153.60	4.92	6.17	7.42	39.18	42.02	44.87	44.91	48.20	51.48
52300	154.71	4.42	5.78	7.14	34.96	37.58	40.21	39.92	43.36	46.81
52300	155.85	4.51	6.08	7.64	37.06	40.00	42.94	42.03	46.08	50.12
52300	156.83	5.06	6.50	7.95	37.40	40.19	42.98	43.05	46.69	50.34
52300	157.62	4.56	5.97	7.38	38.54	41.22	43.90	43.71	47.19	50.67
52300	158.49	4.81	6.21	7.61	37.48	40.50	43.52	42.88	46.70	50.53
52300	159.53	4.41	5.67	6.93	35.12	37.90	40.68	40.19	43.57	46.95
52300	160.56	5.20	6.78	8.36	35.53	38.26	40.99	41.27	45.04	48.82
52300	161.47	4.16	5.58	7.01	37.42	39.93	42.44	42.13	45.51	48.90
52300	162.66	5.49	7.03	8.56	38.49	41.10	43.70	44.69	48.12	51.55
52300	163.61	4.14	5.63	7.13	35.08	37.96	40.85	39.88	43.60	47.32
52300	164.63	4.55	5.65	6.76	36.61	39.21	41.80	41.65	44.86	48.07

52300	165.70	4.28	6.23	8.17	37.77	41.12	44.47	42.63	47.34	52.06
52300	166.76	4.91	6.30	7.68	36.67	39.38	42.09	42.21	45.68	49.14
52300	167.59	4.45	5.53	6.60	36.43	39.07	41.71	41.54	44.60	47.65
52300	168.56	3.69	4.67	5.65	36.76	39.63	42.51	40.93	44.30	47.68
52300	169.73	5.44	6.88	8.32	38.01	40.57	43.13	44.07	47.45	50.83
52300	170.82	4.86	6.16	7.47	37.57	40.29	43.00	43.06	46.45	49.84
52300	171.65	5.18	6.64	8.10	37.69	40.42	43.14	43.34	47.06	50.77
52300	172.87	5.08	6.33	7.58	37.15	39.75	42.36	42.92	46.08	49.25
52300	173.87	4.22	5.59	6.96	37.16	40.04	42.92	41.99	45.63	49.27
52300	175.13	4.29	5.39	6.49	37.83	40.35	42.87	42.59	45.74	48.88
52300	176.49	4.27	5.62	6.98	35.52	38.51	41.49	40.32	44.13	47.94
52300	177.36	4.36	5.62	6.87	35.35	38.39	41.44	40.29	44.01	47.73
52300	178.31	4.89	6.29	7.68	37.79	40.78	43.76	43.32	47.06	50.81
52300	179.43	4.41	5.44	6.48	37.50	40.28	43.07	42.53	45.73	48.93
52300	180.18	4.97	6.26	7.55	37.13	39.70	42.28	42.80	45.96	49.12
52300	181.37	4.42	5.55	6.67	37.45	40.20	42.95	42.50	45.74	48.99
52300	182.37	3.87	4.90	5.93	36.49	38.90	41.32	40.75	43.81	46.86
52300	183.52	4.49	5.62	6.74	35.63	38.26	40.88	40.80	43.87	46.95
52300	184.58	4.05	5.39	6.73	39.25	42.00	44.75	43.82	47.39	50.96
52300	185.60	4.55	5.81	7.08	36.44	38.94	41.43	41.49	44.75	48.01
52300	186.59	4.65	6.15	7.66	36.78	39.81	42.84	42.00	45.96	49.93
52300	187.77	5.24	6.73	8.23	39.35	42.11	44.86	45.36	48.84	52.31
52300	188.61	5.45	7.86	10.28	36.28	39.47	42.66	42.17	47.33	52.50
52300	189.66	5.10	6.42	7.75	34.29	36.81	39.33	40.00	43.23	46.47
52300	190.52	3.85	4.96	6.06	34.75	37.52	40.28	39.06	42.48	45.89
52300	191.55	5.03	6.59	8.14	34.93	37.16	39.39	40.40	43.75	47.10
52300	192.45	4.59	5.81	7.02	36.10	38.90	41.70	41.23	44.71	48.18
52300	193.23	4.03	5.28	6.53	36.57	39.50	42.42	41.20	44.78	48.35
52300	194.27	4.09	5.40	6.71	36.53	38.86	41.19	41.27	44.26	47.25
52300	194.98	4.68	6.45	8.22	38.54	41.32	44.09	43.81	47.77	51.72
52300	196.08	4.32	5.64	6.96	36.85	39.56	42.27	41.89	45.20	48.52
52300	197.14	5.26	6.66	8.05	36.31	38.94	41.58	42.07	45.60	49.13
52300	198.12	4.08	5.80	7.53	34.99	37.83	40.67	39.55	43.63	47.71
52300	199.02	3.80	4.81	5.82	35.99	38.60	41.21	40.40	43.41	46.42
52300	199.83	4.61	5.83	7.05	36.73	39.54	42.35	42.06	45.37	48.67
52300	200.97	5.41	6.63	7.84	36.92	39.38	41.84	43.08	46.01	48.94
52300	202.28	4.37	5.33	6.28	38.00	40.55	43.11	42.92	45.88	48.84
52300	203.35	5.20	6.69	8.18	36.45	39.45	42.45	42.35	46.14	49.92
52300	204.37	4.42	6.24	8.05	37.89	40.87	43.85	42.77	47.11	51.45
52300	205.31	4.66	5.90	7.15	36.59	39.32	42.04	42.00	45.22	48.44
52300	206.49	4.91	6.54	8.18	35.91	38.53	41.16	41.39	45.08	48.76
52300	207.73	3.65	4.41	5.18	34.74	37.14	39.53	38.89	41.55	44.20
52300	208.92	3.96	5.44	6.91	38.27	41.25	44.22	42.81	46.68	50.56
52300	209.79	3.88	5.02	6.15	38.52	41.26	43.99	42.89	46.28	49.66
52300	210.90	4.28	5.44	6.60	35.79	38.24	40.69	40.67	43.68	46.69
52300	211.82	5.02	6.03	7.04	35.00	37.46	39.91	40.59	43.49	46.38
52300	212.64	4.42	5.44	6.47	36.14	38.80	41.46	41.18	44.24	47.31
52300	214.04	4.34	5.42	6.49	35.87	38.25	40.62	40.87	43.66	46.45
52300	215.09	4.52	5.62	6.72	35.59	38.20	40.81	40.69	43.82	46.95
52300	216.20	4.12	4.98	5.83	34.83	37.44	40.05	39.47	42.42	45.38
52300	217.11	5.34	6.60	7.86	35.46	38.05	40.63	41.30	44.65	48.00
52300	218.11	4.52	5.72	6.92	36.49	39.20	41.92	41.59	44.92	48.26
52300	218.99	4.69	5.90	7.11	38.61	41.65	44.69	43.85	47.55	51.25
52300	220.12	4.54	6.08	7.61	36.05	39.11	42.17	41.13	45.19	49.25
52300	221.04	4.25	5.44	6.63	35.40	38.07	40.74	40.19	43.51	46.83
52300	221.94	4.73	5.78	6.84	36.10	38.79	41.49	41.30	44.58	47.85

52300	222.81	4.87	5.93	6.99	37.31	39.94	42.58	42.83	45.87	48.92
52300	223.72	4.06	5.24	6.42	35.17	38.04	40.90	39.71	43.28	46.85
52300	224.70	4.24	5.58	6.91	34.74	37.42	40.09	39.64	42.99	46.35
52300	226.02	5.48	6.83	8.19	38.51	41.34	44.18	44.74	48.18	51.61
52300	227.02	4.04	5.06	6.07	35.25	37.69	40.14	39.88	42.75	45.62
52300	228.08	3.69	4.79	5.88	37.77	40.13	42.48	42.09	44.92	47.74
52300	228.96	4.59	5.60	6.61	37.22	39.74	42.26	42.38	45.35	48.32
52300	230.04	4.59	5.54	6.50	35.49	38.20	40.91	40.72	43.74	46.76
52300	231.21	4.19	5.46	6.74	35.45	37.73	40.02	40.24	43.20	46.16
52300	232.00	3.58	4.99	6.40	38.63	41.22	43.80	43.00	46.21	49.42
52300	232.73	3.75	5.01	6.26	35.17	37.55	39.93	39.52	42.55	45.59
52300	233.71	5.01	6.40	7.78	38.00	40.68	43.35	43.78	47.07	50.36
52300	234.41	4.39	5.49	6.59	38.46	41.03	43.60	43.52	46.51	49.51
52300	235.29	4.45	5.87	7.29	36.78	39.39	42.00	41.88	45.26	48.63
52300	236.35	3.54	4.39	5.24	35.65	38.24	40.83	39.75	42.63	45.51
52300	237.35	4.44	5.74	7.04	37.54	40.12	42.71	42.56	45.86	49.17
52300	238.55	3.53	4.47	5.41	33.20	35.41	37.62	37.17	39.88	42.58
52300	239.68	4.20	5.40	6.60	35.60	38.22	40.84	40.38	43.62	46.86
52300	240.82	4.83	6.18	7.53	38.52	41.25	43.97	44.08	47.43	50.78
52300	241.91	4.64	5.94	7.24	36.06	38.72	41.39	41.32	44.66	47.99
52300	243.09	4.37	5.38	6.40	36.54	38.98	41.43	41.47	44.37	47.27
52300	244.23	4.69	6.27	7.85	35.40	37.72	40.04	40.55	43.99	47.43
52300	245.56	4.50	5.90	7.31	36.12	38.46	40.80	41.26	44.37	47.48
52300	246.62	4.51	5.98	7.44	37.52	40.55	43.58	42.53	46.53	50.52
52300	247.62	4.48	5.75	7.03	34.71	37.32	39.94	39.76	43.08	46.39
52300	248.93	4.35	5.33	6.31	38.39	40.78	43.16	43.25	46.11	48.96
52300	249.84	4.44	5.57	6.69	38.24	40.83	43.41	43.47	46.39	49.32
52300	250.82	4.73	6.15	7.57	37.44	40.50	43.56	42.72	46.65	50.58
52300	252.00	3.90	5.04	6.19	33.40	36.14	38.88	37.94	41.19	44.44
52300	253.03	4.69	5.74	6.80	37.47	40.21	42.95	42.72	45.96	49.19
52300	254.08	4.64	5.77	6.90	34.05	36.54	39.03	39.30	42.31	45.32
52300	255.07	4.09	4.95	5.82	36.52	39.00	41.47	41.10	43.95	46.80
52300	256.01	5.91	7.35	8.80	35.09	37.65	40.22	41.60	45.01	48.41
52300	256.95	4.40	5.95	7.51	37.82	40.84	43.86	42.83	46.79	50.75
52300	258.07	3.89	4.84	5.80	36.90	39.53	42.17	41.34	44.38	47.41
52300	259.03	4.22	5.28	6.34	35.83	38.15	40.46	40.70	43.42	46.15
52300	260.19	5.05	6.10	7.16	41.14	43.96	46.77	46.91	50.06	53.21
52300	261.17	4.98	6.18	7.39	37.87	40.44	43.02	43.53	46.62	49.72
52300	262.17	4.48	5.44	6.40	35.81	38.53	41.24	40.84	43.97	47.10
52300	263.09	4.80	6.10	7.41	38.81	41.70	44.58	44.23	47.80	51.37
52300	264.24	4.12	5.21	6.29	36.38	39.00	41.61	41.29	44.20	47.12
52300	265.30	4.15	5.25	6.34	37.86	40.78	43.70	42.51	46.03	49.54
52300	266.27	3.81	4.76	5.71	35.25	37.98	40.72	39.75	42.74	45.74
52300	266.96	4.71	6.16	7.62	37.29	39.70	42.11	42.69	45.86	49.04
52300	268.20	4.51	5.82	7.13	38.18	41.12	44.06	43.37	46.94	50.52
52300	268.99	4.71	5.80	6.90	34.64	37.34	40.03	40.01	43.14	46.27
52300	270.00	5.52	6.68	7.85	39.05	41.87	44.69	45.36	48.56	51.75
52300	270.96	5.10	6.90	8.70	37.05	39.88	42.70	42.72	46.78	50.83
52300	271.90	4.14	5.35	6.56	34.31	36.95	39.58	39.02	42.30	45.58
52300	272.95	4.20	5.76	7.32	38.25	41.23	44.21	42.99	46.99	50.99
52300	273.91	4.46	5.66	6.85	38.31	40.98	43.65	43.46	46.64	49.82
52300	275.04	5.10	6.43	7.76	38.49	41.02	43.56	44.24	47.46	50.67
52300	275.94	4.54	5.79	7.04	35.95	38.55	41.16	41.02	44.34	47.66
52300	277.18	4.37	5.51	6.64	34.95	37.52	40.09	39.89	43.03	46.17
52300	277.94	5.22	6.58	7.95	36.69	39.61	42.53	42.49	46.19	49.90
52300	278.95	5.16	6.27	7.38	37.15	39.89	42.64	42.96	46.16	49.37

52300	279.94	5.12	6.85	8.59	35.61	38.17	40.72	41.32	45.02	48.72
52300	280.97	4.90	6.31	7.71	35.14	37.59	40.04	40.62	43.89	47.16
52300	282.05	5.01	6.17	7.33	37.32	39.87	42.41	43.02	46.04	49.06
52300	282.85	4.55	5.94	7.32	36.44	39.12	41.80	41.53	45.06	48.58
52300	283.84	5.65	7.22	8.79	37.00	39.86	42.72	43.23	47.08	50.93
52300	284.98	5.07	6.32	7.57	36.61	39.07	41.54	42.31	45.39	48.47
52300	286.23	5.18	6.87	8.56	37.03	39.45	41.87	42.82	46.31	49.81
52300	287.08	5.23	7.17	9.11	39.16	42.39	45.62	45.19	49.56	53.93
52300	288.23	3.79	4.71	5.64	37.59	40.28	42.97	41.89	44.99	48.10
52300	289.34	4.58	5.68	6.78	37.99	40.87	43.76	43.24	46.55	49.87
52300	290.37	5.41	7.34	9.27	35.70	38.65	41.60	41.75	45.99	50.23
52300	291.24	4.70	5.98	7.27	37.43	40.16	42.89	42.91	46.14	49.38
52300	292.14	6.42	8.17	9.93	40.92	43.99	47.07	48.12	52.17	56.22
52300	293.37	4.96	6.21	7.46	33.87	36.44	39.02	39.33	42.65	45.98
52300	294.27	4.60	5.76	6.91	38.54	41.12	43.70	43.66	46.88	50.10
52300	295.22	4.21	5.32	6.43	36.77	39.47	42.17	41.54	44.79	48.04
52300	295.99	5.05	7.17	9.29	37.04	40.34	43.64	42.59	47.51	52.44
52300	297.13	5.52	7.01	8.50	36.82	39.45	42.08	43.16	46.46	49.76
52300	298.21	5.12	6.47	7.81	36.97	39.74	42.51	42.72	46.20	49.69
52300	299.14	5.06	6.54	8.02	39.14	41.63	44.11	44.73	48.17	51.61
52300	300.28	4.82	6.08	7.34	38.77	41.40	44.02	44.10	47.47	50.85
52300	301.38	5.75	7.15	8.55	37.18	39.93	42.68	43.39	47.08	50.76
52300	302.33	4.79	6.15	7.51	36.67	39.25	41.83	42.02	45.40	48.78
52300	303.20	4.32	5.56	6.81	35.66	38.45	41.24	40.68	44.01	47.35
52300	304.27	4.69	6.09	7.50	37.80	40.51	43.21	43.15	46.60	50.06
52300	305.27	4.74	5.82	6.90	37.47	39.94	42.40	42.73	45.76	48.79
52300	306.18	4.85	6.13	7.41	36.99	39.73	42.46	42.51	45.86	49.20
52300	307.14	5.20	6.66	8.11	40.60	44.42	48.24	46.44	51.07	55.71
52300	308.31	5.33	6.61	7.89	38.83	41.57	44.31	44.88	48.18	51.48
52300	309.40	4.63	6.04	7.45	39.65	42.58	45.50	45.01	48.62	52.23
52300	310.38	5.67	7.20	8.73	39.14	42.02	44.89	45.52	49.21	52.90
52300	311.37	5.74	7.39	9.04	37.91	40.84	43.77	44.26	48.23	52.20
52300	312.31	4.45	6.29	8.13	35.54	38.45	41.35	40.48	44.74	49.00
52300	313.02	4.79	6.06	7.32	39.42	42.32	45.21	44.86	48.38	51.89
52300	314.03	4.08	5.31	6.53	38.73	41.48	44.23	43.42	46.79	50.15
52300	315.07	6.34	8.18	10.03	38.02	41.02	44.02	44.81	49.20	53.59
52300	316.19	4.86	6.39	7.91	36.17	39.04	41.90	41.65	45.42	49.19
52300	317.18	4.81	6.73	8.65	35.46	38.38	41.29	40.77	45.11	49.45
52300	318.19	4.61	5.65	6.68	37.67	40.45	43.22	42.85	46.09	49.34
52300	319.23	4.25	5.44	6.64	36.43	39.76	43.08	41.14	45.20	49.26
52300	320.35	6.24	7.73	9.22	38.53	41.45	44.37	45.46	49.18	52.90
52300	321.48	5.78	7.38	8.98	37.39	40.19	42.99	43.78	47.57	51.35
52300	322.35	5.59	7.26	8.94	37.61	40.78	43.96	43.78	48.05	52.32
52300	323.51	5.44	7.23	9.02	39.19	42.39	45.59	45.36	49.62	53.89
52300	324.36	5.38	7.39	9.41	37.91	41.04	44.16	43.86	48.43	53.00
52300	325.54	4.65	6.08	7.51	37.60	40.51	43.42	42.84	46.59	50.35
52300	326.62	5.02	6.65	8.29	39.78	42.54	45.31	45.42	49.20	52.97
52300	327.60	5.09	6.38	7.66	37.85	40.93	44.00	43.60	47.30	51.01
52300	328.50	4.36	5.81	7.26	33.97	36.44	38.92	38.94	42.25	45.56
52300	329.48	6.12	7.75	9.38	38.44	41.33	44.22	44.97	49.08	53.19
52300	330.43	4.93	6.14	7.36	35.63	38.22	40.82	41.13	44.37	47.60
52300	331.57	4.60	5.83	7.06	35.16	37.81	40.46	40.26	43.64	47.02
52300	332.47	4.54	5.69	6.84	38.50	41.24	43.98	43.62	46.93	50.24
52300	333.67	6.40	8.08	9.76	38.91	41.52	44.14	45.81	49.60	53.39
52300	334.69	4.88	6.25	7.61	37.35	40.08	42.82	42.90	46.33	49.76
52300	335.58	4.24	5.34	6.43	36.63	39.46	42.30	41.46	44.80	48.14

52300	336.40	4.57	5.87	7.16	37.08	39.95	42.82	42.14	45.82	49.49
52300	337.40	4.86	6.12	7.39	37.90	41.39	44.89	43.40	47.52	51.63
52300	338.31	5.14	6.60	8.06	37.61	40.23	42.84	43.32	46.83	50.34
52300	339.31	4.42	5.89	7.36	36.38	39.31	42.24	41.35	45.20	49.04
52300	340.16	5.66	6.93	8.20	38.16	40.61	43.05	44.53	47.54	50.54
52300	341.12	5.96	7.82	9.69	36.79	40.17	43.55	43.24	47.99	52.74
52300	342.07	5.64	7.46	9.28	38.84	41.71	44.59	45.24	49.18	53.11
52300	342.86	4.60	5.92	7.24	36.07	38.80	41.53	41.22	44.72	48.22
52300	344.01	4.47	5.76	7.05	38.03	40.82	43.61	43.13	46.58	50.02
52300	345.19	4.73	6.14	7.56	38.49	41.52	44.55	43.76	47.66	51.56
52300	346.35	4.72	6.21	7.70	36.41	39.32	42.24	41.70	45.53	49.36
52300	347.42	4.84	6.09	7.34	35.84	38.64	41.43	41.25	44.72	48.20
52300	348.59	4.58	5.92	7.27	36.88	40.03	43.19	42.09	45.96	49.83
52300	349.54	4.29	5.82	7.35	34.64	37.46	40.28	39.48	43.28	47.08
52300	350.37	5.52	7.52	9.52	38.48	41.23	43.98	44.55	48.75	52.96
52300	351.37	5.66	7.47	9.29	36.88	39.99	43.09	43.18	47.46	51.74
52300	352.25	4.87	6.37	7.87	37.34	40.54	43.73	42.77	46.91	51.06
52300	353.12	4.87	6.18	7.50	40.75	43.65	46.55	46.20	49.83	53.47
52300	354.16	5.18	6.55	7.92	36.98	39.93	42.88	42.67	46.48	50.28
52300	355.28	4.88	6.50	8.13	37.13	40.01	42.90	42.63	46.52	50.40
52300	356.31	4.75	6.29	7.82	35.52	37.97	40.43	40.80	44.26	47.72
52300	357.06	4.78	6.25	7.72	38.50	41.67	44.83	44.07	47.92	51.77
52300	358.02	5.10	6.51	7.91	38.16	40.71	43.26	43.79	47.22	50.64
52300	359.05	4.66	5.98	7.30	36.76	39.07	41.39	41.94	45.05	48.17
52300	360.03	5.91	7.24	8.57	36.66	39.08	41.50	43.17	46.32	49.47
52300	361.12	5.02	6.78	8.55	36.54	39.27	41.99	42.03	46.05	50.07
52300	361.94	4.93	6.16	7.39	35.27	37.83	40.40	40.88	44.00	47.11
52300	362.82	5.18	7.02	8.85	38.35	40.93	43.51	44.12	47.94	51.77
52300	363.78	4.77	7.56	10.36	36.37	39.92	43.47	41.65	47.48	53.32
52300	365.03	4.98	6.33	7.67	39.45	42.67	45.90	44.94	49.00	53.05
52300	366.03	5.53	6.96	8.38	37.12	40.13	43.15	43.29	47.09	50.89
52300	366.85	4.39	5.79	7.20	36.48	39.43	42.37	41.46	45.22	48.98
52300	367.89	4.88	6.15	7.41	38.05	40.31	42.57	43.59	46.45	49.32
52300	368.71	5.18	6.69	8.20	37.78	40.47	43.15	43.78	47.16	50.53
52300	369.73	4.13	5.46	6.79	36.36	39.07	41.78	41.04	44.54	48.04
52300	370.97	5.27	7.19	9.11	36.33	39.33	42.32	42.16	46.52	50.87
52300	371.93	4.98	6.76	8.54	37.94	40.74	43.54	43.47	47.50	51.54
52300	372.80	4.73	6.02	7.30	36.50	39.35	42.19	41.68	45.36	49.05
52300	373.73	4.10	5.14	6.19	35.82	38.45	41.07	40.39	43.59	46.79
52300	374.67	3.93	5.26	6.58	37.10	39.73	42.35	41.68	44.98	48.29
52300	375.68	3.67	4.75	5.84	36.98	39.35	41.72	41.39	44.10	46.81
52300	376.75	4.74	6.16	7.59	39.41	42.11	44.81	44.87	48.27	51.68
52300	377.73	4.58	5.91	7.24	36.68	39.54	42.39	41.77	45.44	49.11
52300	378.85	5.24	6.77	8.30	36.16	39.10	42.04	41.89	45.87	49.85
52300	379.82	5.15	6.52	7.89	36.69	39.54	42.39	42.68	46.06	49.44
52300	380.88	6.17	7.54	8.90	37.67	40.55	43.43	44.55	48.09	51.63
52300	381.79	5.24	6.51	7.78	37.42	39.83	42.25	43.33	46.35	49.36
52300	382.55	3.78	4.86	5.95	35.11	37.72	40.33	39.55	42.59	45.62
52300	383.56	4.34	5.49	6.65	37.14	39.80	42.47	42.16	45.30	48.43
52300	384.73	4.39	6.17	7.94	38.04	41.13	44.22	42.95	47.30	51.64
52300	385.74	4.62	5.73	6.85	35.07	37.49	39.92	40.16	43.23	46.30
52300	386.70	4.81	6.43	8.04	37.89	40.86	43.83	43.48	47.29	51.10
52300	387.63	6.07	7.74	9.41	38.08	40.42	42.76	44.61	48.16	51.71
52300	388.66	4.63	5.99	7.34	38.07	41.13	44.20	43.17	47.12	51.06
52300	389.58	5.32	7.51	9.71	39.51	42.94	46.36	45.42	50.45	55.48
52300	390.50	5.51	6.92	8.32	35.54	38.44	41.34	41.70	45.36	49.01

52300	391.37	4.58	5.93	7.28	36.62	38.98	41.34	41.73	44.90	48.07
52300	392.38	4.49	6.22	7.95	35.37	38.40	41.42	40.42	44.62	48.82
52300	393.45	5.12	6.28	7.44	39.53	42.64	45.74	45.26	48.92	52.57
52300	394.33	3.69	4.42	5.14	38.51	40.96	43.42	42.73	45.38	48.03
52300	395.39	4.18	5.39	6.61	37.12	39.71	42.29	41.87	45.10	48.32
52300	396.30	4.25	5.39	6.54	36.74	39.36	41.98	41.61	44.75	47.90
52300	397.29	4.53	5.78	7.04	36.76	39.23	41.71	41.91	45.02	48.13
52300	398.10	4.39	5.68	6.97	38.46	40.92	43.38	43.42	46.60	49.78
52300	399.08	5.22	7.18	9.14	39.76	42.94	46.11	45.45	50.12	54.78
52300	400.10	4.93	6.19	7.44	36.58	39.15	41.71	42.14	45.33	48.52
52300	401.27	4.49	6.06	7.62	37.00	40.19	43.38	41.95	46.25	50.55
52300	402.16	4.96	6.50	8.05	35.77	38.60	41.42	41.23	45.10	48.97
52300	403.22	3.96	5.01	6.05	37.80	40.46	43.11	42.30	45.46	48.62
52300	404.23	5.06	6.34	7.62	37.44	40.21	42.98	43.13	46.55	49.98
52300	405.12	5.11	7.20	9.29	36.73	39.59	42.44	42.50	46.79	51.08
52300	406.09	4.97	6.14	7.31	36.11	38.82	41.53	41.68	44.97	48.25
52300	407.02	5.03	6.67	8.32	40.63	43.73	46.82	46.30	50.40	54.50
52300	407.94	3.98	5.21	6.45	35.53	37.93	40.33	40.17	43.15	46.12
52300	409.09	4.35	6.01	7.68	36.73	39.93	43.12	41.71	45.94	50.17
52300	410.14	5.53	6.93	8.33	37.25	39.71	42.17	43.53	46.64	49.75
52300	411.07	4.49	5.80	7.11	35.65	38.35	41.04	40.61	44.15	47.68
52300	411.96	4.73	6.01	7.30	37.27	39.65	42.04	42.70	45.67	48.63
52300	412.66	5.70	7.38	9.07	39.25	42.14	45.04	45.51	49.53	53.54
52300	413.59	4.32	5.40	6.49	36.54	39.37	42.19	41.20	44.77	48.34
52300	414.52	4.78	6.51	8.24	37.06	39.73	42.40	42.25	46.24	50.23
52300	415.57	4.97	6.24	7.51	36.23	39.00	41.78	41.73	45.25	48.76
52300	416.62	5.35	6.66	7.98	38.76	41.14	43.51	44.78	47.80	50.82
52300	417.60	4.63	6.12	7.62	34.52	37.44	40.37	39.64	43.57	47.49
52300	418.88	4.42	5.69	6.95	38.90	41.92	44.94	43.84	47.61	51.37
52300	419.62	4.66	6.44	8.21	37.51	40.48	43.44	42.69	46.91	51.14
52300	420.77	4.10	5.21	6.32	35.18	37.75	40.32	39.93	42.96	45.98
52300	421.83	5.40	6.90	8.40	36.77	39.14	41.51	42.81	46.04	49.27
52300	422.86	4.38	5.35	6.32	36.41	38.64	40.86	41.43	43.99	46.54
52300	423.81	4.52	5.72	6.92	37.09	39.53	41.96	42.45	45.25	48.04
52300	424.91	5.07	6.58	8.10	37.61	40.05	42.48	43.27	46.63	49.99
52300	425.80	5.75	7.38	9.02	37.88	40.62	43.36	44.14	48.00	51.86
52300	426.93	6.25	8.12	10.00	37.50	40.48	43.46	44.34	48.60	52.87
52300	427.99	4.78	6.16	7.54	36.85	39.68	42.51	42.15	45.84	49.52
52300	429.03	3.81	4.88	5.95	36.66	39.48	42.30	40.92	44.36	47.80
52300	429.85	4.29	5.26	6.22	35.73	38.34	40.95	40.56	43.60	46.63
52300	430.82	5.26	7.01	8.75	36.85	39.76	42.67	42.50	46.77	51.04
52300	431.82	4.97	6.33	7.69	36.13	38.86	41.59	41.63	45.19	48.75
52300	432.95	3.54	4.57	5.59	37.84	40.77	43.70	41.93	45.33	48.74
52300	433.98	3.79	4.73	5.67	35.30	38.24	41.17	39.51	42.97	46.42
52300	435.10	4.20	5.16	6.12	38.33	41.35	44.37	43.08	46.51	49.94
52300	436.12	5.45	6.76	8.07	35.44	37.94	40.44	41.45	44.70	47.95
52300	437.09	4.90	6.21	7.52	36.68	39.30	41.93	42.12	45.52	48.91
52300	438.16	4.02	4.96	5.90	35.78	38.19	40.60	40.42	43.15	45.87
52300	439.04	4.21	5.42	6.62	37.06	39.92	42.77	41.86	45.33	48.81
52300	440.08	4.52	5.66	6.80	34.34	36.90	39.46	39.54	42.56	45.58
52300	441.22	4.44	5.97	7.50	36.93	39.74	42.54	42.01	45.71	49.40
52300	442.30	4.04	4.85	5.66	35.26	37.54	39.83	39.84	42.40	44.96
52300	443.33	5.16	6.53	7.91	38.10	40.50	42.90	43.83	47.03	50.24
52300	444.33	4.16	5.21	6.26	35.47	38.09	40.70	40.19	43.29	46.39
52300	445.48	5.32	6.69	8.05	38.28	41.05	43.82	44.35	47.74	51.13
52300	446.20	4.49	5.88	7.27	36.25	38.86	41.48	41.38	44.74	48.10

52300	447.34	4.50	5.80	7.10	36.43	39.12	41.81	41.54	44.92	48.31
52300	448.46	4.82	6.00	7.19	37.49	40.16	42.82	42.80	46.16	49.52
52300	449.57	5.53	7.09	8.65	38.81	41.74	44.67	44.89	48.83	52.77
52300	450.63	5.49	6.66	7.83	37.12	39.55	41.97	43.38	46.21	49.04
52300	451.73	5.28	7.06	8.85	38.42	41.84	45.25	44.29	48.90	53.50
52300	452.77	4.54	5.74	6.93	36.80	39.14	41.47	41.88	44.87	47.86
52300	453.78	4.18	5.29	6.40	35.59	38.30	41.01	40.44	43.59	46.74
52300	454.69	4.71	5.95	7.18	34.28	36.69	39.11	39.66	42.64	45.61
52300	455.78	5.48	6.94	8.40	37.81	40.35	42.89	43.97	47.29	50.61
52300	456.91	4.52	5.86	7.20	34.83	37.61	40.39	39.88	43.47	47.05
52300	458.09	5.11	6.74	8.36	35.94	38.54	41.13	41.61	45.28	48.94
52300	458.85	4.45	5.90	7.35	40.17	43.14	46.12	45.42	49.04	52.67
52300	460.01	5.10	6.64	8.17	38.22	41.19	44.16	43.96	47.83	51.69
52300	460.78	4.20	5.35	6.51	37.71	40.40	43.08	42.52	45.75	48.98
52300	461.64	4.33	5.52	6.71	37.67	40.74	43.80	42.65	46.26	49.86
52300	462.53	4.37	5.66	6.94	36.98	39.85	42.71	41.84	45.50	49.17
52300	463.62	4.03	5.12	6.22	36.64	39.30	41.96	41.36	44.42	47.49
52300	464.31	5.10	6.77	8.45	38.70	41.80	44.91	44.47	48.58	52.68
52300	465.27	4.45	5.81	7.17	36.14	38.87	41.59	41.31	44.68	48.04
52300	466.19	4.85	6.42	8.00	35.18	38.10	41.02	40.63	44.53	48.42
52300	467.16	4.53	5.45	6.38	35.99	38.60	41.21	41.12	44.05	46.98
52300	468.19	5.61	7.12	8.64	37.91	40.62	43.33	44.16	47.74	51.31
52300	469.09	4.76	5.91	7.05	35.86	38.26	40.66	41.33	44.17	47.01
52300	470.35	4.83	6.00	7.17	37.64	40.71	43.78	43.07	46.71	50.34
52300	471.51	5.68	6.81	7.95	37.54	40.10	42.67	43.79	46.92	50.04
52300	472.68	4.92	6.25	7.58	38.69	41.54	44.38	44.35	47.79	51.23
52300	473.98	4.68	5.89	7.10	37.92	40.56	43.19	43.34	46.45	49.55
52300	475.38	4.51	6.20	7.89	36.92	39.74	42.57	41.98	45.94	49.91
52300	476.40	4.92	6.40	7.89	39.92	42.94	45.97	45.59	49.34	53.10
52300	477.34	3.51	4.54	5.56	35.44	37.94	40.44	39.57	42.48	45.38
52300	478.24	5.11	6.39	7.67	37.29	40.64	43.98	42.85	47.03	51.21
52300	479.31	4.89	5.93	6.97	34.92	37.19	39.47	40.27	43.12	45.97
52300	480.18	4.56	6.05	7.53	34.97	37.61	40.24	40.21	43.66	47.10
52300	481.05	5.17	6.56	7.96	38.56	41.43	44.29	44.39	47.99	51.59
52300	482.24	5.15	6.71	8.27	36.99	39.91	42.82	42.70	46.62	50.53
52300	483.14	4.93	6.28	7.63	37.62	40.74	43.86	43.18	47.01	50.85
52300	484.08	5.40	6.79	8.17	38.17	40.98	43.79	44.20	47.77	51.34
52300	485.02	4.99	6.12	7.25	38.82	41.96	45.10	44.41	48.08	51.75
52300	486.15	5.51	6.89	8.28	36.52	39.08	41.64	42.52	45.97	49.43
52300	487.00	5.86	7.73	9.61	36.30	38.93	41.55	42.67	46.66	50.65
52300	487.90	4.74	5.98	7.23	35.12	38.01	40.90	40.43	43.99	47.56
52300	489.02	4.70	5.82	6.93	38.71	41.57	44.43	44.03	47.39	50.74
52300	490.07	5.81	7.48	9.15	37.30	40.18	43.06	43.57	47.66	51.75
52300	491.05	5.43	7.01	8.58	38.59	41.69	44.78	44.64	48.69	52.75
52300	491.90	4.78	6.39	8.00	38.50	41.50	44.50	43.91	47.89	51.87
52300	492.89	5.22	6.92	8.63	37.95	40.84	43.73	43.79	47.76	51.74
52300	493.75	5.18	6.60	8.02	35.30	37.90	40.50	41.00	44.50	48.01
52300	494.59	4.88	6.15	7.43	37.35	40.27	43.18	42.88	46.42	49.96
52300	495.58	3.17	3.99	4.81	35.74	38.52	41.29	39.48	42.51	45.54
52300	496.45	4.36	5.42	6.47	37.66	40.06	42.47	42.68	45.48	48.28
52300	497.51	4.10	5.35	6.61	36.08	38.57	41.06	40.77	43.92	47.07
52300	498.53	3.86	4.76	5.67	37.56	40.27	42.98	42.08	45.04	47.99
52300	499.47	4.97	6.17	7.37	38.31	41.22	44.12	43.78	47.39	50.99
52300	500.47	4.38	5.41	6.44	37.39	40.27	43.16	42.48	45.69	48.89

2. INFLUENCE OF MESSAGE INTERARRIVAL TIME ON SYSTEM PERFORMANCE

LN	M.N	P.N	B.C	M.M	P.M	DEL	
52525	3000	5	110	2.50	24.00	24.00	500
52424	3000	5	110	2.40	24.00	24.00	500
52323	3000	5	110	2.30	24.00	24.00	500
52222	3000	5	110	2.20	24.00	24.00	500
52121	3000	5	110	2.10	24.00	24.00	500
52020	3000	5	110	2.00	24.00	24.00	500
51919	3000	5	110	1.90	24.00	24.00	500
51818	3000	5	110	1.80	24.00	24.00	500
51717	3000	5	110	1.70	24.00	24.00	500
51616	3000	5	110	1.60	24.00	24.00	500
51515	3000	5	110	1.50	24.00	24.00	500

AVER	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
52525				0.0273				
52525				0.0287				
52525				0.0301				
52525	3.2615	1.9954	1.2657	0.0185	1.9833	0.3967	2.8346	0.3988
52525	3.2759	2.0038	1.2721	0.0190	1.9914	0.3983	2.8466	0.4004
52525	3.2903	2.0121	1.2785	0.0195	1.9996	0.3999	2.8586	0.4021
52424				0.0337				
52424				0.0353				
52424				0.0369				
52424	3.4042	2.0786	1.3252	0.0196	2.0652	0.4130	2.9541	0.4153
52424	3.4191	2.0872	1.3319	0.0201	2.0737	0.4147	2.9665	0.4171
52424	3.4340	2.0959	1.3385	0.0206	2.0822	0.4164	2.9789	0.4188
52323				0.0427				
52323				0.0452				
52323				0.0477				
52323	3.5612	2.1690	1.3918	0.0205	2.1544	0.4309	3.0838	0.4334
52323	3.5779	2.1780	1.3999	0.0211	2.1633	0.4327	3.0971	0.4352
52323	3.5946	2.1870	1.4079	0.0217	2.1721	0.4344	3.1104	0.4370
52222				0.0606				

52222				0.0649				
52222				0.0691				
52222	3.7463	2.2675	1.4780	0.0216	2.2516	0.4503	3.2306	0.4531
52222	3.7646	2.2770	1.4876	0.0223	2.2609	0.4522	3.2444	0.4549
52222	3.7829	2.2864	1.4973	0.0229	2.2701	0.4540	3.2581	0.4568
52121				0.0869				
52121				0.0932				
52121				0.0995				
52121	3.9580	2.3755	1.5814	0.0223	2.3580	0.4716	3.3937	0.4746
52121	3.9788	2.3854	1.5934	0.0230	2.3677	0.4735	3.4085	0.4765
52121	3.9996	2.3953	1.6054	0.0238	2.3773	0.4755	3.4234	0.4785
52020				0.1465				
52020				0.1587				
52020				0.1710				
52020	4.2310	2.4942	1.7347	0.0241	2.4744	0.4949	3.5819	0.4982
52020	4.2580	2.5046	1.7534	0.0251	2.4844	0.4969	3.5979	0.5002
52020	4.2850	2.5150	1.7721	0.0260	2.4944	0.4989	3.6140	0.5023
51919				0.2581				
51919				0.2808				
51919				0.3035				
51919	4.5841	2.6254	1.9556	0.0263	2.6025	0.5205	3.7967	0.5243
51919	4.6227	2.6364	1.9863	0.0274	2.6131	0.5226	3.8146	0.5264
51919	4.6613	2.6473	2.0170	0.0286	2.6236	0.5247	3.8325	0.5286
51818				0.5623				
51818				0.6186				
51818				0.6749				
51818	5.1947	2.7712	2.4193	0.0326	2.7427	0.5485	4.0704	0.5527
51818	5.2700	2.7828	2.4872	0.0354	2.7536	0.5507	4.0926	0.5550
51818	5.3452	2.7943	2.5551	0.0382	2.7645	0.5529	4.1148	0.5572
51717				1.4571				
51717				1.6107				
51717				1.7643				
51717	6.5206	2.9400	3.5777	0.0485	2.8915	0.5783	4.4329	0.5833
51717	6.7122	2.9515	3.7607	0.0545	2.9021	0.5804	4.4643	0.5855
51717	6.9038	2.9630	3.9437	0.0604	2.9126	0.5825	4.4956	0.5876
51616				5.0427				
51616				5.6398				
51616				6.2369				
51616	10.6697	3.1168	7.5496	0.1419	3.0116	0.6023	4.8952	0.6078
51616	11.3118	3.1290	8.1828	0.1638	3.0204	0.6041	4.9324	0.6096
51616	11.9539	3.1411	8.8161	0.1856	3.0293	0.6059	4.9696	0.6114
51515				18.9794				
51515				20.2241				
51515				21.4688				
51515	25.4649	3.3250	22.1364	0.6801	3.0366	0.6073	5.2611	0.6132
51515	26.7526	3.3388	23.4138	0.7347	3.0440	0.6088	5.2791	0.6147
51515	28.0403	3.3527	24.6911	0.7893	3.0514	0.6103	5.2972	0.6162

AVER	AVG. ATT	MISS. P	REC. BK	CAP. T	HOLD. T	COMP. T
52525	1.0095	0.0095	0.0138	4.9436	33.6844	38.6486
52525	1.0101	0.0100	0.0151	4.9694	33.7431	38.7125
52525	1.0106	0.0104	0.0164	4.9951	33.8018	38.7764
52424	1.0107	0.0112	0.0208	5.0098	33.7524	38.7807
52424	1.0114	0.0117	0.0225	5.0356	33.8029	38.8385
52424	1.0120	0.0122	0.0242	5.0615	33.8534	38.8964
52323	1.0132	0.0136	0.0309	5.1230	33.7719	38.9146
52323	1.0141	0.0143	0.0331	5.1577	33.8276	38.9853
52323	1.0150	0.0151	0.0353	5.1923	33.8833	39.0559
52222	1.0186	0.0183	0.0482	5.3478	33.8071	39.1766
52222	1.0201	0.0195	0.0512	5.4028	33.8598	39.2625
52222	1.0217	0.0207	0.0541	5.4578	33.9124	39.3485
52121	1.0266	0.0248	0.0724	5.6670	33.8768	39.5735
52121	1.0289	0.0265	0.0762	5.7429	33.9313	39.6742
52121	1.0312	0.0281	0.0799	5.8187	33.9858	39.7749
52020	1.0446	0.0390	0.1173	6.3627	34.0302	40.4170
52020	1.0491	0.0418	0.1225	6.4964	34.0844	40.5808
52020	1.0537	0.0447	0.1278	6.6300	34.1386	40.7446
51919	1.0799	0.0630	0.1828	7.5401	34.1634	41.7363
51919	1.0882	0.0676	0.1908	7.7738	34.2248	41.9986
51919	1.0964	0.0722	0.1988	8.0076	34.2861	42.2608
51818	1.1800	0.1191	0.3045	10.5748	34.5147	45.1168
51818	1.2001	0.1279	0.3166	11.1101	34.5784	45.6885
51818	1.2201	0.1367	0.3288	11.6454	34.6421	46.2601
51717	1.4651	0.2372	0.5055	18.4474	34.8197	53.3019
51717	1.5160	0.2531	0.5252	19.7649	34.8937	54.6587
51717	1.5669	0.2690	0.5449	21.0824	34.9678	56.0154
51616	2.5679	0.4780	0.7800	46.3299	35.0383	81.4286
51616	2.7521	0.5007	0.7995	50.8323	35.1051	85.9374
51616	2.9362	0.5233	0.8189	55.3346	35.1718	90.4462
51515	6.3739	0.7665	0.9488	138.6028	34.9375	173.6059
51515	6.7042	0.7785	0.9535	146.5569	35.0122	181.5691
51515	7.0345	0.7904	0.9581	154.5109	35.0869	189.5323

AVER	C. P. U	TIME	ARRMES	REAL. AR	REAL. RE	CAP. P. P	HOL. P REP
52525	17.7	6215.07	2500.00	2483.78	2497.77	143.38	
52525	17.8	6241.03	2500.00	2484.64	2498.04	146.62	50.00100
52525	17.9	6266.98	2500.00	2485.50	2498.31	149.86	
52424	18.3	5966.48	2500.00	2482.99	2497.38	132.07	
52424	18.4	5991.40	2500.00	2483.82	2497.70	134.85	50.00100
52424	18.5	6016.32	2500.00	2484.65	2498.02	137.63	

52323	12.3	5717.90	2500.00	2482.23	2497.17	119.85	
52323	12.4	5741.78	2500.00	2483.14	2497.53	123.04	50.00100
52323	12.4	5765.66	2500.00	2484.05	2497.89	126.22	
52222	12.9	5469.35	2500.00	2481.35	2497.13	103.11	
52222	12.9	5492.19	2500.00	2482.34	2497.48	106.06	50.00100
52222	13.0	5515.02	2500.00	2483.33	2497.83	109.00	
52121	20.9	5220.79	2500.00	2480.52	2496.76	88.53	
52121	21.0	5242.59	2500.00	2481.47	2497.17	91.15	50.00100
52121	21.1	5264.39	2500.00	2482.42	2497.58	93.78	
52020	14.6	4972.26	2500.00	2478.73	2495.89	70.46	
52020	14.8	4993.02	2500.00	2479.84	2496.43	72.56	50.00100
52020	14.9	5013.78	2500.00	2480.95	2496.97	74.66	
51919	24.2	4723.74	2500.00	2476.84	2495.41	55.35	
51919	24.5	4743.46	2500.00	2477.93	2496.02	57.08	50.00100
51919	24.8	4763.17	2500.00	2479.01	2496.63	58.81	
51818	18.7	4475.26	2500.00	2472.03	2491.55	40.08	
51818	19.2	4493.94	2500.00	2473.85	2492.97	41.38	50.00100
51818	19.7	4512.61	2500.00	2475.67	2494.39	42.68	
51717	26.2	4220.26	2500.00	2455.10	2476.61	28.29	
51717	27.7	4236.82	2500.00	2458.25	2479.60	29.30	50.00100
51717	29.2	4253.37	2500.00	2461.40	2482.59	30.31	
51616	64.1	3980.83	2500.00	2407.01	2428.93	19.62	
51616	73.5	3996.49	2500.00	2413.73	2435.63	20.17	50.00100
51616	82.8	4012.16	2500.00	2420.45	2442.33	20.73	
51515	356.4	3729.94	2500.00	2269.60	2291.60	15.53	
51515	393.8	3745.51	2500.00	2280.24	2302.24	15.67	50.00100
51515	431.2	3761.07	2500.00	2290.88	2312.88	15.81	

3. INFLUENCE OF TRANSIT TIME ON SYSTEM PERFORMANCE

LN	M.N	P.N	B.C	M.M	P.M	DEL	
51524	3000	5	110	2.00000	15.00	24.00	500
51624	3000	5	110	2.00000	16.00	24.00	500
51724	3000	5	110	2.00000	17.00	24.00	500
51824	3000	5	110	2.00000	18.00	24.00	500
51924	3000	5	110	2.00000	19.00	24.00	500
52024	3000	5	110	2.00000	20.00	24.00	500
52124	3000	5	110	2.00000	21.00	24.00	500
52224	3000	5	110	2.00000	22.00	24.00	500
52324	3000	5	110	2.00000	23.00	24.00	500
52424	3000	5	110	2.00000	24.00	24.00	500
52524	3000	5	110	2.00000	25.00	24.00	500
52624	3000	5	110	2.00000	26.00	24.00	500
52724	3000	5	110	2.00000	27.00	24.00	500
52824	3000	5	110	2.00000	28.00	24.00	500
52924	3000	5	110	2.00000	29.00	24.00	500
53024	3000	5	110	2.00000	30.00	24.00	500
53124	3000	5	110	2.00000	31.00	24.00	500
53224	3000	5	110	2.00000	32.00	24.00	500
53324	3000	5	110	2.00000	33.00	24.00	500
53424	3000	5	110	2.00000	34.00	24.00	500
53524	3000	5	110	2.00000	35.00	24.00	500
53624	3000	5	110	2.00000	36.00	24.00	500
53724	3000	5	110	2.00000	37.00	24.00	500
53824	3000	5	110	2.00000	38.00	24.00	500

53924	3000	5	110	2.00000	39.00	24.00	500	
54024	3000	5	110	2.00000	40.00	24.00	500	
54124	3000	5	110	2.00000	41.00	24.00	500	
54224	3000	5	110	2.00000	42.00	24.00	500	
54324	3000	5	110	2.00000	43.00	24.00	500	
54424	3000	5	110	2.00000	44.00	24.00	500	

AVER	T. TRAN	N. TRAN	RE. TRAN	ATTRITI	P. REC	M. REC	OUT. SY	RES
51524				0.0214				
51524				0.0225				
51524				0.0237				
51524	3.4046	2.4942	0.9017	0.0155	2.4804	0.4961	3.0156	0.4985
51524	3.4463	2.5046	0.9416	0.0160	2.4906	0.4981	3.0281	0.5006
51524	3.4879	2.5150	0.9816	0.0166	2.5009	0.5002	3.0407	0.5026
51624				0.0257				
51624				0.0273				
51624				0.0288				
51624	3.6113	2.4992	1.1117	0.0157	2.4843	0.4969	3.0849	0.4995
51624	3.6261	2.5090	1.1171	0.0162	2.4939	0.4988	3.0970	0.5015
51624	3.6408	2.5188	1.1225	0.0167	2.5036	0.5007	3.1092	0.5034
51724				0.0298				
51724				0.0318				
51724				0.0338				
51724	3.6674	2.4938	1.1731	0.0172	2.4774	0.4955	3.1374	0.4984
51724	3.6827	2.5035	1.1792	0.0178	2.4871	0.4974	3.1498	0.5004
51724	3.6980	2.5132	1.1853	0.0184	2.4968	0.4994	3.1622	0.5023
51824				0.0383				
51824				0.0412				
51824				0.0442				
51824	3.7404	2.4958	1.2440	0.0174	2.4791	0.4958	3.2013	0.4988
51824	3.7576	2.5059	1.2517	0.0180	2.4892	0.4978	3.2148	0.5008
51824	3.7748	2.5160	1.2595	0.0186	2.4992	0.4998	3.2284	0.5028
51924				0.0445				
51924				0.0477				
51924				0.0509				
51924	3.7925	2.4857	1.3062	0.0181	2.4687	0.4937	3.2497	0.4967
51924	3.8103	2.4957	1.3146	0.0188	2.4785	0.4957	3.2634	0.4987
51924	3.8281	2.5057	1.3231	0.0195	2.4883	0.4977	3.2771	0.5007
52024				0.0582				
52024				0.0625				
52024				0.0667				
52024	3.8750	2.4897	1.3846	0.0197	2.4722	0.4944	3.3175	0.4975
52024	3.8949	2.5002	1.3947	0.0203	2.4824	0.4965	3.3320	0.4996
52024	3.9148	2.5107	1.4048	0.0208	2.4926	0.4985	3.3465	0.5016

52124				0.0673				
52124				0.0720				
52124				0.0767				
52124	3.9392	2.4854	1.4532	0.0196	2.4675	0.4935	3.3734	0.4966
52124	3.9587	2.4951	1.4636	0.0202	2.4770	0.4954	3.3872	0.4985
52124	3.9782	2.5048	1.4741	0.0209	2.4865	0.4973	3.4010	0.5004
52224				0.0905				
52224				0.0968				
52224				0.1031				
52224	4.0307	2.4874	1.5424	0.0209	2.4681	0.4936	3.4407	0.4969
52224	4.0514	2.4967	1.5546	0.0215	2.4773	0.4955	3.4547	0.4988
52224	4.0720	2.5061	1.5668	0.0221	2.4866	0.4973	3.4687	0.5006
52324				0.1148				
52324				0.1226				
52324				0.1304				
52324	4.1287	2.4941	1.6332	0.0222	2.4739	0.4948	3.5125	0.4982
52324	4.1505	2.5035	1.6470	0.0230	2.4831	0.4966	3.5267	0.5001
52324	4.1723	2.5128	1.6609	0.0237	2.4923	0.4985	3.5408	0.5019
52424				0.1380				
52424				0.1492				
52424				0.1605				
52424	4.2094	2.4905	1.7170	0.0232	2.4690	0.4938	3.5692	0.4973
52424	4.2361	2.5007	1.7354	0.0241	2.4789	0.4958	3.5856	0.4993
52424	4.2628	2.5110	1.7537	0.0251	2.4888	0.4978	3.6020	0.5013
52524				0.1691				
52524				0.1815				
52524				0.1939				
52524	4.3073	2.4914	1.8146	0.0249	2.4699	0.4940	3.6372	0.4976
52524	4.3358	2.5009	1.8349	0.0258	2.4793	0.4959	3.6538	0.4995
52524	4.3644	2.5103	1.8553	0.0268	2.4887	0.4977	3.6704	0.5014
52624				0.2213				
52624				0.2400				
52624				0.2587				
52624	4.4309	2.4902	1.9392	0.0265	2.4685	0.4937	3.7090	0.4973
52624	4.4693	2.5009	1.9684	0.0275	2.4790	0.4958	3.7289	0.4994
52624	4.5078	2.5117	1.9975	0.0286	2.4896	0.4979	3.7487	0.5016
52724				0.2735				
52724				0.2953				
52724				0.3171				
52724	4.5575	2.4931	2.0622	0.0291	2.4701	0.4940	3.7808	0.4977
52724	4.5966	2.5027	2.0939	0.0303	2.4793	0.4959	3.7993	0.4996
52724	4.6357	2.5124	2.1255	0.0316	2.4886	0.4977	3.8177	0.5015
52824				0.3213				
52824				0.3491				
52824				0.3770				
52824	4.6653	2.4882	2.1747	0.0306	2.4642	0.4928	3.8422	0.4965
52824	4.7125	2.4983	2.2142	0.0322	2.4741	0.4948	3.8627	0.4985
52824	4.7597	2.5084	2.2536	0.0339	2.4840	0.4968	3.8832	0.5005

52924				0.4116				
52924				0.4492				
52924				0.4869				
52924	4.8486	2.4933	2.3529	0.0336	2.4671	0.4934	3.9323	0.4974
52924	4.9077	2.5042	2.4035	0.0359	2.4777	0.4955	3.9558	0.4995
52924	4.9668	2.5151	2.4541	0.0382	2.4883	0.4977	3.9794	0.5016
53024				0.4873				
53024				0.5283				
53024				0.5692				
53024	4.9929	2.4895	2.5010	0.0375	2.4625	0.4925	4.0023	0.4964
53024	5.0566	2.5000	2.5566	0.0399	2.4724	0.4945	4.0258	0.4984
53024	5.1203	2.5104	2.6122	0.0422	2.4823	0.4965	4.0494	0.5005
53124				0.6017				
53124				0.6527				
53124				0.7037				
53124	5.2041	2.4930	2.7090	0.0395	2.4654	0.4931	4.0956	0.4970
53124	5.2600	2.5027	2.7773	0.0420	2.4748	0.4950	4.1206	0.4990
53124	5.3558	2.5124	2.8455	0.0445	2.4843	0.4969	4.1457	0.5009
53224				0.7524				
53224				0.8095				
53224				0.8666				
53224	5.4722	2.4995	2.9706	0.0456	2.4694	0.4939	4.1997	0.4980
53224	5.5541	2.5088	3.0453	0.0485	2.4784	0.4957	4.2246	0.4998
53224	5.6359	2.5180	3.1200	0.0513	2.4874	0.4975	4.2495	0.5016
53324				0.8375				
53324				0.9059				
53324				0.9744				
53324	5.6082	2.4923	3.1137	0.0478	2.4611	0.4922	4.2577	0.4962
53324	5.7023	2.5016	3.2006	0.0515	2.4699	0.4940	4.2846	0.4980
53324	5.7964	2.5110	3.2875	0.0553	2.4788	0.4958	4.3116	0.4998
53424				1.0479				
53424				1.1272				
53424				1.2064				
53424	5.9539	2.4942	3.4570	0.0565	2.4631	0.4926	4.3758	0.4967
53424	6.0617	2.5046	3.5571	0.0609	2.4728	0.4946	4.4058	0.4986
53424	6.1695	2.5150	3.6571	0.0653	2.4826	0.4965	4.4357	0.5006
53524				1.2299				
53524				1.3262				
53524				1.4225				
53524	6.2573	2.4992	3.7560	0.0625	2.4628	0.4926	4.4758	0.4968
53524	6.3879	2.5090	3.8789	0.0673	2.4720	0.4944	4.5075	0.4987
53524	6.5184	2.5188	4.0018	0.0722	2.4811	0.4962	4.5392	0.5005
53624				1.4000				
53624				1.5100				
53624				1.6200				
53624	6.5206	2.4938	4.0246	0.0704	2.4529	0.4906	4.5516	0.4948
53624	6.6700	2.5035	4.1665	0.0772	2.4619	0.4924	4.5859	0.4967
53624	6.8194	2.5132	4.3084	0.0840	2.4710	0.4942	4.6202	0.4985

53724				1.6599				
53724				1.8119				
53724				1.9640				
53724	6.9268	2.4958	4.4286	0.0802	2.4536	0.4907	4.6589	0.4950
53724	7.1137	2.5059	4.6078	0.0889	2.4628	0.4926	4.6967	0.4969
53724	7.3007	2.5160	4.7871	0.0976	2.4721	0.4944	4.7346	0.4987
53824				1.8007				
53824				1.9665				
53824				2.1323				
53824	7.1515	2.4857	4.6641	0.0850	2.4446	0.4889	4.7401	0.4932
53824	7.3564	2.4957	4.8607	0.0962	2.4534	0.4907	4.7772	0.4949
53824	7.5613	2.5057	5.0574	0.1074	2.4621	0.4924	4.8143	0.4967
53924				2.2184				
53924				2.3939				
53924				2.5694				
53924	7.8079	2.4897	5.3163	0.1049	2.4424	0.4885	4.8661	0.4928
53924	8.0379	2.5002	5.5377	0.1165	2.4514	0.4903	4.9074	0.4946
53924	8.2678	2.5107	5.7590	0.1282	2.4604	0.4921	4.9487	0.4964
54024				2.5761				
54024				2.7912				
54024				3.0063				
54024	8.3138	2.4854	5.8261	0.1179	2.4347	0.4869	4.9719	0.4912
54024	8.5788	2.4951	6.0837	0.1346	2.4431	0.4886	5.0123	0.4929
54024	8.8438	2.5048	6.3413	0.1513	2.4515	0.4903	5.0526	0.4946
54124				2.9732				
54124				3.1804				
54124				3.3877				
54124	8.8857	2.4874	6.3965	0.1382	2.4319	0.4864	5.0871	0.4907
54124	9.1494	2.4967	6.6526	0.1540	2.4395	0.4879	5.1271	0.4922
54124	9.4130	2.5061	6.9088	0.1698	2.4471	0.4894	5.1671	0.4938
54224				3.4223				
54224				3.6606				
54224				3.8990				
54224	9.5183	2.4941	7.0225	0.1656	2.4305	0.4861	5.2077	0.4905
54224	9.8044	2.5035	7.3010	0.1841	2.4385	0.4877	5.2487	0.4921
54224	10.0905	2.5128	7.5795	0.2027	2.4465	0.4893	5.2897	0.4937
54324				3.9383				
54324				4.2684				
54324				4.5986				
54324	10.2183	2.4905	7.7263	0.1833	2.4222	0.4844	5.3209	0.4888
54324	10.5900	2.5007	8.0893	0.2079	2.4302	0.4860	5.3676	0.4904
54324	10.9618	2.5110	8.4523	0.2326	2.4383	0.4877	5.4142	0.4920
54424				4.4027				
54424				4.7412				
54424				5.0797				
54424	10.8003	2.4914	8.3071	0.2167	2.4186	0.4837	5.4285	0.4881
54424	11.1831	2.5009	8.6822	0.2491	2.4266	0.4853	5.4728	0.4897
54424	11.5659	2.5103	9.0573	0.2815	2.4345	0.4869	5.5171	0.4913

AVER	AVG. ATT	MISS. P	REC. BK	CAP. T	HOLD. T	COMP. T
51524	1.0009	0.0070	0.0073	3.0567	25.1981	28.2665
51524	1.0011	0.0074	0.0081	3.0719	25.2431	28.3150
51524	1.0012	0.0077	0.0089	3.0871	25.2881	28.3634
51624	1.0017	0.0082	0.0119	3.3060	26.2934	29.6134
51624	1.0021	0.0087	0.0129	3.3252	26.3330	29.6582
51624	1.0024	0.0092	0.0139	3.3444	26.3726	29.7030
51724	1.0024	0.0093	0.0157	3.5374	27.3240	30.8729
51724	1.0028	0.0100	0.0171	3.5579	27.3685	30.9264
51724	1.0031	0.0106	0.0184	3.5783	27.4131	30.9799
51824	1.0045	0.0117	0.0240	3.8302	28.3613	32.2043
51824	1.0051	0.0126	0.0261	3.8611	28.4134	32.2745
51824	1.0057	0.0134	0.0282	3.8920	28.4654	32.3447
51924	1.0062	0.0134	0.0311	4.0965	29.3811	33.4933
51924	1.0070	0.0143	0.0333	4.1308	29.4335	33.5643
51924	1.0078	0.0152	0.0355	4.1651	29.4860	33.6353
52024	1.0103	0.0171	0.0436	4.4452	30.3497	34.8093
52024	1.0114	0.0183	0.0466	4.4909	30.4046	34.8955
52024	1.0125	0.0194	0.0496	4.5367	30.4594	34.9817
52124	1.0138	0.0194	0.0536	4.7838	31.2773	36.0796
52124	1.0151	0.0207	0.0569	4.8353	31.3336	36.1689
52124	1.0164	0.0219	0.0602	4.8868	31.3898	36.2581
52224	1.0222	0.0254	0.0737	5.2541	32.2481	37.5216
52224	1.0242	0.0271	0.0779	5.3236	32.3013	37.6249
52224	1.0261	0.0287	0.0820	5.3931	32.3545	37.7282
52324	1.0315	0.0314	0.0931	5.7389	33.1354	38.8975
52324	1.0341	0.0334	0.0978	5.8281	33.1963	39.0244
52324	1.0367	0.0353	0.1024	5.9172	33.2572	39.1512
52424	1.0423	0.0369	0.1113	6.2543	33.9337	40.2133
52424	1.0464	0.0396	0.1167	6.3805	33.9908	40.3713
52424	1.0506	0.0422	0.1222	6.5068	34.0478	40.5292
52524	1.0560	0.0440	0.1367	6.8541	34.8197	41.6987
52524	1.0606	0.0469	0.1427	6.9968	34.8739	41.8706
52524	1.0653	0.0497	0.1488	7.1394	34.9279	42.0425
52624	1.0793	0.0557	0.1688	7.7333	35.6730	43.4324
52624	1.0863	0.0596	0.1770	7.9431	35.7405	43.6836
52624	1.0934	0.0636	0.1851	8.1528	35.8079	43.9347
52724	1.1045	0.0666	0.1997	8.6221	36.4422	45.0943
52724	1.1131	0.0711	0.2084	8.8710	36.5059	45.3769
52724	1.1216	0.0756	0.2171	9.1199	36.5697	45.6594

52824	1.1283	0.0760	0.2272	9.4542	37.1685	46.6469
52824	1.1396	0.0815	0.2375	9.7729	37.2318	47.0047
52824	1.1509	0.0869	0.2479	10.0916	37.2950	47.3625
52924	1.1729	0.0936	0.2711	10.8611	37.9214	48.8191
52924	1.1884	0.1000	0.2825	11.2795	37.9834	49.2628
52924	1.2040	0.1063	0.2938	11.6979	38.0453	49.7065
53024	1.2116	0.1067	0.3036	12.0422	38.6022	50.6920
53024	1.2287	0.1136	0.3161	12.5010	38.6789	51.1799
53024	1.2458	0.1206	0.3286	12.9598	38.7556	51.6679
53124	1.2703	0.1255	0.3525	13.7577	39.2612	53.0588
53124	1.2918	0.1336	0.3656	14.3288	39.3308	53.6596
53124	1.3134	0.1417	0.3788	14.9000	39.4003	54.2604
53224	1.3461	0.1493	0.4064	15.9127	39.9533	55.9091
53224	1.3706	0.1575	0.4193	16.5498	40.0080	56.5578
53224	1.3952	0.1657	0.4323	17.1869	40.0627	57.2065
53324	1.3960	0.1610	0.4314	17.2982	40.4225	57.7901
53324	1.4256	0.1704	0.4448	18.0622	40.4861	58.5484
53324	1.4552	0.1797	0.4583	18.8263	40.5497	59.3066
53424	1.5026	0.1887	0.4891	20.1877	40.9735	61.2244
53424	1.5372	0.1988	0.5044	21.0689	41.0359	62.1049
53424	1.5717	0.2090	0.5197	21.9502	41.0984	62.9854
53524	1.5958	0.2108	0.5348	22.6843	41.4219	64.1881
53524	1.6372	0.2215	0.5495	23.7348	41.4876	65.2224
53524	1.6786	0.2322	0.5642	24.7852	41.5533	66.2567
53624	1.6876	0.2290	0.5674	25.0692	41.8444	66.9951
53624	1.7348	0.2408	0.5828	26.2605	41.9135	68.1740
53624	1.7821	0.2526	0.5981	27.4517	41.9826	69.3529
53724	1.8181	0.2555	0.6092	28.4339	42.1899	70.7292
53724	1.8824	0.2688	0.6251	30.0334	42.2583	72.2917
53724	1.9468	0.2821	0.6410	31.6329	42.3266	73.8541
53824	1.9100	0.2685	0.6427	30.8224	42.5892	73.5213
53824	1.9784	0.2817	0.6580	32.5182	42.6657	75.1839
53824	2.0468	0.2950	0.6734	34.2139	42.7422	76.8465
53924	2.1049	0.3036	0.6819	35.7440	42.7591	78.6486
53924	2.1786	0.3176	0.6966	37.5620	42.8545	80.4164
53924	2.2523	0.3315	0.7114	39.3799	42.9498	82.1842
54024	2.2850	0.3317	0.7168	40.2544	43.1420	83.5178
54024	2.3747	0.3461	0.7310	42.4514	43.2239	85.6753
54024	2.4644	0.3606	0.7451	44.6484	43.3058	87.8328
54124	2.4816	0.3592	0.7512	45.1260	43.3558	88.6165
54124	2.5669	0.3728	0.7642	47.2198	43.4428	90.6626
54124	2.6523	0.3864	0.7772	49.3136	43.5298	92.7087

54224	2.6932	0.3869	0.7821	50.3536	43.4873	94.0106
54224	2.7892	0.4005	0.7932	52.6928	43.5963	96.2891
54224	2.8851	0.4141	0.8044	55.0320	43.7053	98.5677
54324	2.9393	0.4124	0.8081	56.4274	43.7002	100.3123
54324	3.0728	0.4279	0.8194	59.6735	43.8129	103.4864
54324	3.2063	0.4434	0.8307	62.9196	43.9256	106.6604
54424	3.1559	0.4354	0.8308	61.7160	43.8574	105.7465
54424	3.2885	0.4504	0.8412	64.9371	43.9716	108.9086
54424	3.4210	0.4654	0.8516	68.1581	44.0858	112.0708

AVER	C.P.U	TIME	ARRMES	REAL.AR	REAL.RE	CAP.P.P	HOL.P REP
51524	8.1	4972.26	2500.00	2485.22	2497.99	131.25	
51524	8.1	4993.02	2500.00	2486.05	2498.25	134.54	50.00100
51524	8.2	5013.77	2500.00	2486.88	2498.51	137.83	
51624	8.6	4964.58	2500.00	2484.17	2498.18	126.69	
51624	8.6	4984.07	2500.00	2485.00	2498.42	130.04	50.00100
51624	8.7	5003.55	2500.00	2485.83	2498.66	133.38	
51724	9.2	4975.38	2500.00	2482.83	2498.07	122.47	
51724	9.2	4994.96	2500.00	2483.63	2498.32	125.95	50.00100
51724	9.3	5014.54	2500.00	2484.43	2498.57	129.42	
51824	9.8	4970.16	2500.00	2482.44	2497.79	112.43	
51824	9.9	4990.31	2500.00	2483.31	2498.07	116.07	50.00100
51824	9.9	5010.46	2500.00	2484.18	2498.35	119.71	
51924	10.5	4990.75	2500.00	2481.90	2497.48	107.72	
51924	10.5	5010.73	2500.00	2482.80	2497.81	111.15	50.00100
51924	10.6	5030.71	2500.00	2483.70	2498.14	114.58	
52024	11.1	4980.95	2500.00	2481.30	2497.27	97.80	
52024	11.2	5001.87	2500.00	2482.22	2497.65	101.01	50.00100
52024	11.3	5022.80	2500.00	2483.14	2498.03	104.21	
52124	11.8	4992.37	2500.00	2481.11	2497.18	93.98	
52124	11.8	5011.77	2500.00	2481.90	2497.50	96.77	50.00100
52124	11.9	5031.16	2500.00	2482.69	2497.82	99.56	
52224	12.6	4989.50	2500.00	2479.54	2496.61	83.95	
52224	12.7	5008.35	2500.00	2480.59	2497.08	86.50	50.00100
52224	12.8	5027.19	2500.00	2481.64	2497.55	89.05	
52324	13.6	4976.21	2500.00	2478.82	2496.53	77.12	
52324	13.7	4994.84	2500.00	2479.66	2496.96	79.53	50.00100
52324	13.8	5013.45	2500.00	2480.50	2497.39	81.94	
52424	14.4	4980.27	2500.00	2477.02	2495.16	72.43	
52424	14.6	5000.68	2500.00	2478.19	2495.88	74.56	50.00100
52424	14.7	5021.10	2500.00	2479.36	2496.60	76.69	
52524	15.6	4981.13	2500.00	2477.41	2495.89	67.59	

52524	15.7	5000.07	2500.00	2478.45	2496.46	69.51	50.00100
52524	15.8	5019.00	2500.00	2479.49	2497.03	71.42	
52624	17.1	4979.00	2500.00	2476.99	2495.44	61.24	
52624	17.3	5000.49	2500.00	2478.11	2496.11	63.13	50.00100
52624	17.5	5021.98	2500.00	2479.23	2496.78	65.02	
52724	18.2	4977.19	2500.00	2475.32	2494.38	56.96	
52724	18.4	4996.42	2500.00	2476.65	2495.19	58.73	50.00100
52724	18.6	5015.65	2500.00	2477.98	2496.00	60.50	
52824	19.2	4985.31	2500.00	2474.34	2493.33	54.27	
52824	19.5	5005.45	2500.00	2475.78	2494.38	56.04	50.00100
52824	19.8	5025.59	2500.00	2477.22	2495.42	57.80	
52924	20.7	4972.27	2500.00	2472.16	2492.28	49.54	
52924	21.1	4994.08	2500.00	2473.55	2493.33	51.04	50.00100
52924	21.5	5015.88	2500.00	2474.94	2494.38	52.55	
53024	22.3	4981.52	2500.00	2470.79	2490.87	47.19	
53024	22.7	5002.33	2500.00	2472.52	2492.28	48.61	50.00100
53024	23.1	5023.14	2500.00	2474.25	2493.69	50.03	
53124	24.3	4977.27	2500.00	2470.54	2490.78	44.14	
53124	24.8	4996.54	2500.00	2472.19	2492.09	45.51	50.00100
53124	25.3	5015.80	2500.00	2473.84	2493.40	46.89	
53224	26.5	4965.75	2500.00	2468.23	2488.96	41.07	
53224	27.1	4984.23	2500.00	2469.75	2490.25	42.16	50.00100
53224	27.6	5002.70	2500.00	2471.27	2491.54	43.25	
53324	28.2	4979.89	2500.00	2466.32	2486.88	40.08	
53324	28.9	4998.55	2500.00	2468.39	2488.67	41.19	50.00100
53324	29.6	5017.22	2500.00	2470.46	2490.46	42.30	
53424	31.7	4972.26	2500.00	2466.34	2486.95	37.55	
53424	32.5	4993.02	2500.00	2468.36	2488.71	38.57	50.00100
53424	33.3	5013.77	2500.00	2470.38	2490.47	39.59	
53524	34.7	4964.58	2500.00	2460.93	2482.32	36.04	
53524	35.7	4984.07	2500.00	2463.18	2484.41	36.94	50.00100
53524	36.8	5003.55	2500.00	2465.43	2486.50	37.85	
53624	37.9	4975.38	2500.00	2455.98	2477.52	35.05	
53624	39.2	4994.96	2500.00	2458.58	2480.02	35.99	50.00100
53624	40.4	5014.54	2500.00	2461.18	2482.52	36.94	
53724	42.2	4970.16	2500.00	2453.99	2475.50	33.62	
53724	44.1	4990.31	2500.00	2457.16	2478.56	34.50	50.00100
53724	46.0	5010.46	2500.00	2460.33	2481.62	35.38	
53824	45.0	4990.75	2500.00	2454.73	2476.27	33.22	
53824	47.2	5010.73	2500.00	2457.76	2479.18	34.01	50.00100
53824	49.4	5030.71	2500.00	2460.79	2482.09	34.79	
53924	51.6	4980.95	2500.00	2447.49	2469.20	31.80	

53924	53.9	5001.87	2500.00	2451.42	2473.06	32.56	50.00100
53924	56.2	5022.80	2500.00	2455.35	2476.92	33.32	
54024	57.8	4992.37	2500.00	2444.50	2466.20	30.81	
54024	61.1	5011.77	2500.00	2448.06	2469.69	31.48	50.00100
54024	64.5	5031.16	2500.00	2451.62	2473.18	32.14	
54124	63.9	4989.50	2500.00	2438.88	2460.65	30.03	
54124	66.9	5008.35	2500.00	2442.91	2464.63	30.66	50.00100
54124	69.9	5027.19	2500.00	2446.94	2468.61	31.28	
54224	71.8	4976.21	2500.00	2430.84	2452.76	29.31	
54224	75.4	4994.84	2500.00	2435.28	2457.17	29.87	50.00100
54224	79.1	5013.45	2500.00	2439.72	2461.58	30.43	
54324	81.9	4980.27	2500.00	2425.14	2447.02	28.71	
54324	87.4	5000.68	2500.00	2429.81	2451.68	29.28	50.00100
54324	92.9	5021.10	2500.00	2434.48	2456.34	29.86	
54424	91.1	4981.13	2500.00	2420.53	2442.42	28.22	
54424	97.5	5000.07	2500.00	2425.98	2447.87	28.76	50.00100
54424	103.8	5019.00	2500.00	2431.43	2453.32	29.29	

4. INFLUENCE OF RETRANSMISSION TIME ON SYSTEM PERFORMANCE

LN	M.N	P.N	B.C	M.M	P.M	DEL	
52216	3000	5	110	2.00	24.00	16.00	500
52217	3000	5	110	2.00	24.00	17.00	500
52218	3000	5	110	2.00	24.00	18.00	500
52219	3000	5	110	2.00	24.00	19.00	500
52220	3000	5	110	2.00	24.00	20.00	500
52221	3000	5	110	2.00	24.00	21.00	500
52222	3000	5	110	2.00	24.00	22.00	500
52223	3000	5	110	2.00	24.00	23.00	500
52224	3000	5	110	2.00	24.00	24.00	500
52225	3000	5	110	2.00	24.00	25.00	500
52226	3000	5	110	2.00	24.00	26.00	500
52227	3000	5	110	2.00	24.00	27.00	500
52228	3000	5	110	2.00	24.00	28.00	500
52229	3000	5	110	2.00	24.00	29.00	500
52230	3000	5	110	2.00	24.00	30.00	500
52231	3000	5	110	2.00	24.00	31.00	500
52232	3000	5	110	2.00	24.00	32.00	500
52233	3000	5	110	2.00	24.00	33.00	500
52234	3000	5	110	2.00	24.00	34.00	500
52235	3000	5	110	2.00	24.00	35.00	500

AVER	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
52216				0.0450				
52216				0.0470				
52216				0.0490				
52216	4.7071	2.4942	2.2125	0.0294	2.4775	0.4955	4.1621	0.4984

52216	4.7280	2.5046	2.2234	0.0302	2.4877	0.4975	4.1796	0.5004
52216	4.7489	2.5150	2.2343	0.0310	2.4979	0.4996	4.1971	0.5025
52217				0.0518				
52217				0.0541				
52217				0.0565				
52217	4.6252	2.4992	2.1255	0.0278	2.4821	0.4964	4.0719	0.4993
52217	4.6444	2.5090	2.1354	0.0286	2.4918	0.4984	4.0882	0.5013
52217	4.6637	2.5188	2.1454	0.0293	2.5015	0.5003	4.1045	0.5032
52218				0.0544				
52218				0.0567				
52218				0.0590				
52218	4.5252	2.4938	2.0309	0.0266	2.4752	0.4950	3.9700	0.4982
52218	4.5441	2.5035	2.0406	0.0273	2.4849	0.4970	3.9858	0.5002
52218	4.5630	2.5132	2.0504	0.0280	2.4945	0.4989	4.0017	0.5021
52219				0.0652				
52219				0.0687				
52219				0.0722				
52219	4.4586	2.4958	1.9622	0.0267	2.4773	0.4955	3.8918	0.4986
52219	4.4800	2.5059	1.9741	0.0274	2.4874	0.4975	3.9091	0.5006
52219	4.5015	2.5160	1.9861	0.0280	2.4975	0.4995	3.9265	0.5026
52220				0.0710				
52220				0.0753				
52220				0.0797				
52220	4.3681	2.4857	1.8817	0.0248	2.4670	0.4934	3.7979	0.4966
52220	4.3889	2.4957	1.8932	0.0256	2.4769	0.4954	3.8138	0.4986
52220	4.4097	2.5057	1.9047	0.0263	2.4867	0.4973	3.8297	0.5006
52221				0.0868				
52221				0.0936				
52221				0.1003				
52221	4.3301	2.4897	1.8393	0.0255	2.4710	0.4942	3.7438	0.4974
52221	4.3537	2.5002	1.8535	0.0263	2.4811	0.4962	3.7602	0.4994
52221	4.3774	2.5107	1.8678	0.0271	2.4912	0.4982	3.7766	0.5015
52222				0.0975				
52222				0.1045				
52222				0.1115				
52222	4.2855	2.4942	1.7899	0.0246	2.4756	0.4951	3.6867	0.4983
52222	4.3078	2.5046	1.8032	0.0253	2.4858	0.4972	3.7025	0.5003
52222	4.3300	2.5150	1.8164	0.0261	2.4959	0.4992	3.7182	0.5024
52223				0.1152				
52223				0.1240				
52223				0.1327				
52223	4.2443	2.4942	1.7486	0.0238	2.4750	0.4950	3.6279	0.4982
52223	4.2688	2.5046	1.7642	0.0246	2.4852	0.4970	3.6441	0.5003
52223	4.2934	2.5150	1.7799	0.0254	2.4954	0.4991	3.6603	0.5023
52224				0.1465				
52224				0.1587				
52224				0.1710				
52224	4.2310	2.4942	1.7347	0.0241	2.4744	0.4949	3.5819	0.4982

52224	4.2580	2.5046	1.7534	0.0251	2.4844	0.4969	3.5979	0.5002
52224	4.2850	2.5150	1.7721	0.0260	2.4944	0.4989	3.6140	0.5023
52225				0.1721				
52225				0.1863				
52225				0.2004				
52225	4.2083	2.4942	1.7117	0.0235	2.4743	0.4949	3.5335	0.4981
52225	4.2367	2.5046	1.7321	0.0244	2.4843	0.4969	3.5496	0.5002
52225	4.2651	2.5150	1.7525	0.0253	2.4944	0.4989	3.5656	0.5023
52226				0.2204				
52226				0.2395				
52226				0.2586				
52226	4.2156	2.4942	1.7188	0.0241	2.4729	0.4946	3.4928	0.4981
52226	4.2500	2.5046	1.7454	0.0251	2.4830	0.4966	3.5093	0.5002
52226	4.2844	2.5150	1.7720	0.0261	2.4930	0.4986	3.5259	0.5022
52227				0.2766				
52227				0.3039				
52227				0.3313				
52227	4.2343	2.4942	1.7368	0.0249	2.4722	0.4944	3.4542	0.4980
52227	4.2762	2.5046	1.7716	0.0263	2.4821	0.4964	3.4710	0.5001
52227	4.3181	2.5150	1.8064	0.0277	2.4921	0.4984	3.4878	0.5021
52228				0.3694				
52228				0.4108				
52228				0.4521				
52228	4.3059	2.4992	1.8035	0.0257	2.4746	0.4949	3.4321	0.4987
52228	4.3634	2.5090	1.8544	0.0273	2.4842	0.4968	3.4499	0.5006
52228	4.4209	2.5188	1.9052	0.0289	2.4937	0.4987	3.4676	0.5025
52229				0.4770				
52229				0.5266				
52229				0.5761				
52229	4.3720	2.4938	1.8753	0.0273	2.4654	0.4931	3.3896	0.4970
52229	4.4381	2.5035	1.9346	0.0294	2.4749	0.4950	3.4077	0.4989
52229	4.5041	2.5132	1.9938	0.0314	2.4844	0.4969	3.4259	0.5009
52230				0.6658				
52230				0.7801				
52230				0.8943				
52230	4.5438	2.4958	2.0447	0.0310	2.4649	0.4930	3.3697	0.4970
52230	4.6767	2.5059	2.1708	0.0359	2.4744	0.4949	3.3904	0.4989
52230	4.8096	2.5160	2.2969	0.0408	2.4838	0.4968	3.4111	0.5008
52231				0.8661				
52231				1.0190				
52231				1.1719				
52231	4.7139	2.4857	2.2254	0.0343	2.4523	0.4905	3.3355	0.4945
52231	4.8849	2.4957	2.3892	0.0421	2.4607	0.4921	3.3554	0.4962
52231	5.0559	2.5057	2.5531	0.0500	2.4692	0.4938	3.3752	0.4979
52232				1.6365				
52232				1.9200				
52232				2.2035				
52232	5.4918	2.4897	2.9992	0.0667	2.4382	0.4876	3.3326	0.4918

52232	5.7959	2.5002	3.2957	0.0831	2.4461	0.4892	3.3530	0.4934
52232	6.0999	2.5107	3.5921	0.0995	2.4539	0.4908	3.3734	0.4950
52233				3.1180				
52233				3.6236				
52233				4.1293				
52233	7.0025	2.4942	4.5052	0.1267	2.4163	0.4833	3.3274	0.4876
52233	7.5265	2.5046	5.0219	0.1639	2.4235	0.4847	3.3474	0.4890
52233	8.0504	2.5150	5.5385	0.2011	2.4306	0.4861	3.3674	0.4904
52234				5.4230				
52234				6.1197				
52234				6.8165				
52234	9.2922	2.4942	6.7950	0.2770	2.3664	0.4733	3.2765	0.4777
52234	10.0043	2.5046	7.4997	0.3327	2.3737	0.4747	3.2930	0.4791
52234	10.7164	2.5150	8.2044	0.3883	2.3810	0.4762	3.3095	0.4806
52235				8.8261				
52235				9.6876				
52235				10.5492				
52235	12.6591	2.4942	10.1619	0.5609	2.2964	0.4593	3.1864	0.4637
52235	13.5313	2.5046	11.0267	0.6500	2.3050	0.4610	3.1997	0.4654
52235	14.4036	2.5150	11.8916	0.7392	2.3135	0.4627	3.2129	0.4671

AVER	AVG.ATT	MISS.P	REC.BK	CAP.T	HOLD.T	COMP.T
52216	1.0436	0.0107	0.0200	4.9151	28.2460	33.1837
52216	1.0446	0.0111	0.0214	4.9394	28.2922	33.2316
52216	1.0456	0.0115	0.0229	4.9638	28.3384	33.2796
52217	1.0398	0.0125	0.0288	5.0203	29.0615	34.1009
52217	1.0409	0.0130	0.0306	5.0471	29.1084	34.1555
52217	1.0421	0.0136	0.0323	5.0740	29.1553	34.2101
52218	1.0349	0.0135	0.0348	5.0854	29.8014	34.9063
52218	1.0360	0.0140	0.0366	5.1130	29.8507	34.9637
52218	1.0371	0.0145	0.0384	5.1406	29.9001	35.0212
52219	1.0342	0.0164	0.0444	5.2268	30.5565	35.8025
52219	1.0357	0.0172	0.0470	5.2658	30.6045	35.8703
52219	1.0372	0.0180	0.0496	5.3048	30.6525	35.9380
52220	1.0322	0.0182	0.0525	5.3182	31.2012	36.5445
52220	1.0339	0.0193	0.0555	5.3661	31.2504	36.6165
52220	1.0355	0.0203	0.0584	5.4141	31.2995	36.6886
52221	1.0342	0.0225	0.0659	5.5309	31.9548	37.5089
52221	1.0367	0.0241	0.0697	5.6000	32.0058	37.6059
52221	1.0392	0.0257	0.0734	5.6691	32.0569	37.7028
52222	1.0344	0.0256	0.0778	5.6954	32.5933	38.3144
52222	1.0370	0.0273	0.0818	5.7733	32.6483	38.4216
52222	1.0395	0.0290	0.0858	5.8511	32.7034	38.5287
52223	1.0371	0.0305	0.0942	5.9435	33.2542	39.2212

52223	1.0404	0.0326	0.0990	6.0405	33.3098	39.3503
52223	1.0437	0.0347	0.1038	6.1375	33.3653	39.4794
52224	1.0446	0.0390	0.1173	6.3627	34.0302	40.4170
52224	1.0491	0.0418	0.1225	6.4964	34.0844	40.5808
52224	1.0537	0.0447	0.1278	6.6300	34.1386	40.7446
52225	1.0507	0.0460	0.1371	6.7237	34.6769	41.4321
52225	1.0560	0.0493	0.1436	6.8854	34.7430	41.6284
52225	1.0612	0.0527	0.1500	7.0472	34.8091	41.8247
52226	1.0640	0.0586	0.1654	7.3397	35.4237	42.7899
52226	1.0709	0.0630	0.1734	7.5652	35.4931	43.0582
52226	1.0778	0.0674	0.1813	7.7907	35.5625	43.3266
52227	1.0791	0.0730	0.1964	8.0978	36.1455	44.2712
52227	1.0892	0.0790	0.2060	8.4213	36.2236	44.6449
52227	1.0993	0.0849	0.2156	8.7448	36.3017	45.0185
52228	1.1084	0.0948	0.2388	9.3446	36.9087	46.2758
52228	1.1234	0.1033	0.2517	9.8460	37.0024	46.8484
52228	1.1383	0.1118	0.2647	10.3475	37.0960	47.4210
52229	1.1421	0.1197	0.2805	10.7703	37.7311	48.5233
52229	1.1599	0.1297	0.2949	11.3792	37.8304	49.2096
52229	1.1778	0.1397	0.3093	11.9881	37.9297	49.8959
52230	1.2063	0.1564	0.3341	13.3171	38.5612	51.9124
52230	1.2483	0.1735	0.3543	14.6999	38.6960	53.3959
52230	1.2902	0.1906	0.3744	16.0828	38.8308	54.8795
52231	1.2747	0.1937	0.3924	16.1700	39.5452	55.7442
52231	1.3281	0.2137	0.4148	17.9702	39.6931	57.6633
52231	1.3816	0.2336	0.4373	19.7705	39.8410	59.5825
52232	1.5392	0.2980	0.5093	25.9235	40.9109	66.8646
52232	1.6393	0.3256	0.5354	29.2926	41.0862	70.3788
52232	1.7393	0.3532	0.5616	32.6616	41.2615	73.8930
52233	2.0726	0.4391	0.6485	45.3099	42.4620	87.7976
52233	2.2463	0.4685	0.6785	51.2290	42.6788	93.9078
52233	2.4200	0.4978	0.7086	57.1481	42.8956	100.0180
52234	2.8512	0.5720	0.7581	73.9443	44.1290	118.1008
52234	3.0877	0.6001	0.7842	82.1526	44.3559	126.5085
52234	3.3241	0.6282	0.8103	90.3608	44.5827	134.9161
52235	3.9724	0.6975	0.8418	115.9637	45.8717	161.8583
52235	4.2489	0.7185	0.8618	125.7724	46.1042	171.8765
52235	4.5255	0.7395	0.8817	135.5810	46.3366	181.8947

AVER	C.P.U	TIME	ARRMES	REAL.AR	REAL.RE	CAP.P.P	HOL.P REP
52216	16.8	4972.26	2500.00	2482.27	2497.21	109.77	
52216	16.9	4993.02	2500.00	2483.15	2497.52	111.84	33.33100

52216	17.0	5013.78	2500.00	2484.03	2497.83	113.91	
52217	16.5	4964.58	2500.00	2481.92	2496.95	104.52	
52217	16.5	4984.07	2500.00	2482.88	2497.34	106.76	35.42100
52217	16.6	5003.55	2500.00	2483.84	2497.73	109.00	
52218	15.9	4975.38	2500.00	2480.55	2496.97	103.87	
52218	16.0	4994.96	2500.00	2481.41	2497.31	105.88	37.50100
52218	16.0	5014.54	2500.00	2482.27	2497.64	107.89	
52219	15.6	4970.16	2500.00	2480.63	2496.69	96.61	
52219	15.7	4990.32	2500.00	2481.54	2497.10	98.84	39.58100
52219	15.8	5010.47	2500.00	2482.45	2497.51	101.08	
52220	15.2	4990.75	2500.00	2480.35	2496.94	93.98	
52220	15.3	5010.73	2500.00	2481.18	2497.28	96.41	41.67100
52220	15.4	5030.71	2500.00	2482.01	2497.62	98.84	
52221	15.1	4980.95	2500.00	2479.90	2496.48	86.67	
52221	15.2	5001.88	2500.00	2480.97	2496.99	89.27	43.75100
52221	15.3	5022.80	2500.00	2482.04	2497.50	91.87	
52222	14.5	4972.26	2500.00	2480.27	2496.61	83.14	
52222	14.6	4993.02	2500.00	2481.21	2497.04	85.32	45.83100
52222	14.7	5013.78	2500.00	2482.15	2497.46	87.51	
52223	21.1	4972.26	2500.00	2479.61	2496.31	77.98	
52223	21.2	4993.02	2500.00	2480.64	2496.78	80.31	47.92100
52223	21.4	5013.78	2500.00	2481.67	2497.25	82.64	
52224	14.6	4972.26	2500.00	2478.73	2495.89	70.46	
52224	14.8	4993.02	2500.00	2479.84	2496.43	72.56	50.00100
52224	14.9	5013.78	2500.00	2480.95	2496.97	74.66	
52225	21.0	4972.26	2500.00	2478.67	2495.85	66.24	
52225	21.1	4993.02	2500.00	2479.81	2496.42	68.36	52.08100
52225	21.3	5013.78	2500.00	2480.95	2496.99	70.49	
52226	21.1	4972.26	2500.00	2477.29	2495.53	59.96	
52226	21.3	4993.02	2500.00	2478.42	2496.19	62.04	54.17100
52226	21.5	5013.78	2500.00	2479.55	2496.85	64.13	
52227	14.8	4972.26	2500.00	2476.31	2494.88	54.70	
52227	15.0	4993.02	2500.00	2477.61	2495.73	56.60	56.25100
52227	15.3	5013.78	2500.00	2478.91	2496.58	58.49	
52228	15.2	4964.58	2500.00	2473.71	2493.00	49.05	
52228	15.6	4984.07	2500.00	2475.31	2494.16	51.04	58.33100
52228	15.9	5003.55	2500.00	2476.91	2495.32	53.03	
52229	15.5	4975.38	2500.00	2469.53	2489.61	44.44	
52229	15.9	4994.96	2500.00	2471.48	2491.28	46.31	60.42100
52229	16.4	5014.54	2500.00	2473.43	2492.95	48.19	
52230	16.9	4970.16	2500.00	2465.96	2486.31	39.72	
52230	18.0	4990.32	2500.00	2468.63	2488.68	41.74	62.50100

52230	19.1	5010.47	2500.00	2471.30	2491.05	43.75	
52231	18.4	4990.75	2500.00	2461.44	2482.06	36.09	
52231	20.3	5010.73	2500.00	2465.23	2485.63	37.81	64.58100
52231	22.2	5030.71	2500.00	2469.02	2489.20	39.53	
52232	26.5	4980.95	2500.00	2439.51	2460.70	29.42	
52232	30.3	5001.88	2500.00	2446.35	2467.39	30.90	66.67100
52232	34.2	5022.80	2500.00	2453.19	2474.08	32.37	
52233	46.1	4972.26	2500.00	2410.59	2432.20	24.19	
52233	56.0	4993.02	2500.00	2419.72	2441.21	25.21	68.75100
52233	65.9	5013.78	2500.00	2428.85	2450.22	26.23	
52234	90.4	4972.26	2500.00	2358.19	2380.12	21.29	
52234	106.2	4993.02	2500.00	2370.43	2392.34	22.01	70.83100
52234	121.9	5013.78	2500.00	2382.67	2404.56	22.73	
52235	173.4	4972.26	2500.00	2287.20	2309.13	19.50	
52235	198.7	4993.02	2500.00	2302.09	2323.97	19.90	72.92100
52235	224.0	5013.78	2500.00	2316.98	2338.81	20.29	

5. INFLUENCE OF RECEIVER BUFFER SIZE ON SYSTEM PERFORMANCE

LN	M.N	P.N	B.C	M.M	P.M	DEL	
52600	3000	5	130	2.00	24.00	24.00	500
52500	3000	5	125	2.00	24.00	24.00	500
52400	3000	5	120	2.00	24.00	24.00	500
52300	3000	5	115	2.00	24.00	24.00	500
52200	3000	5	110	2.00	24.00	24.00	500
52100	3000	5	105	2.00	24.00	24.00	500
52000	3000	5	100	2.00	24.00	24.00	500
51900	3000	5	95	2.00	24.00	24.00	500
51800	3000	5	90	2.00	24.00	24.00	500
51700	3000	5	85	2.00	24.00	24.00	500

AVER	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
52600				0.0320				
52600				0.0336				
52600				0.0353				
52600	4.0741	2.4942	1.5795	0.0214	2.4750	0.4950	3.5424	0.4983
52600	4.0919	2.5046	1.5873	0.0221	2.4852	0.4970	3.5572	0.5004
52600	4.1096	2.5150	1.5950	0.0227	2.4953	0.4991	3.5719	0.5025
52500				0.0405				
52500				0.0431				
52500				0.0458				
52500	4.0866	2.4942	1.5918	0.0211	2.4749	0.4950	3.5460	0.4983
52500	4.1048	2.5046	1.6002	0.0219	2.4851	0.4970	3.5608	0.5004
52500	4.1231	2.5150	1.6086	0.0226	2.4952	0.4990	3.5756	0.5025
52400				0.0594				
52400				0.0634				
52400				0.0673				
52400	4.1116	2.4942	1.6165	0.0223	2.4751	0.4950	3.5517	0.4983
52400	4.1307	2.5046	1.6261	0.0229	2.4852	0.4970	3.5666	0.5004
52400	4.1498	2.5150	1.6357	0.0235	2.4953	0.4991	3.5815	0.5025
52300				0.0861				
52300				0.0926				
52300				0.0991				

52300	4.1483	2.4942	1.6528	0.0222	2.4747	0.4949	3.5608	0.4983
52300	4.1701	2.5046	1.6655	0.0229	2.4849	0.4970	3.5764	0.5003
52300	4.1919	2.5150	1.6782	0.0237	2.4950	0.4990	3.5919	0.5024
52200				0.1465				
52200				0.1587				
52200				0.1710				
52200	4.2310	2.4942	1.7347	0.0241	2.4744	0.4949	3.5819	0.4982
52200	4.2580	2.5046	1.7534	0.0251	2.4844	0.4969	3.5979	0.5002
52200	4.2850	2.5150	1.7721	0.0260	2.4944	0.4989	3.6140	0.5023
52100				0.2511				
52100				0.2710				
52100				0.2909				
52100	4.3635	2.4942	1.8663	0.0263	2.4736	0.4947	3.6094	0.4981
52100	4.3980	2.5046	1.8933	0.0273	2.4837	0.4967	3.6261	0.5001
52100	4.4324	2.5150	1.9204	0.0284	2.4937	0.4987	3.6428	0.5022
52000				0.5153				
52000				0.5733				
52000				0.6313				
52000	4.6843	2.4942	2.1866	0.0328	2.4719	0.4944	3.6648	0.4978
52000	4.7608	2.5046	2.2562	0.0352	2.4817	0.4963	3.6855	0.4998
52000	4.8372	2.5150	2.3257	0.0376	2.4916	0.4983	3.7062	0.5018
51900				1.2855				
51900				1.4265				
51900				1.5675				
51900	5.5743	2.4942	3.0766	0.0565	2.4636	0.4927	3.7650	0.4962
51900	5.7373	2.5046	3.2326	0.0654	2.4729	0.4946	3.7888	0.4981
51900	5.9002	2.5150	3.3887	0.0742	2.4823	0.4965	3.8126	0.5000
51800				3.7074				
51800				4.1351				
51800				4.5628				
51800	8.2450	2.4992	5.7434	0.1598	2.4337	0.4867	3.9062	0.4903
51800	8.6971	2.5090	6.1881	0.1931	2.4413	0.4883	3.9321	0.4918
51800	9.1491	2.5188	6.6327	0.2264	2.4489	0.4898	3.9580	0.4933
51700				13.7190				
51700				14.8773				
51700				16.0356				
51700	18.5665	2.4942	16.0701	1.1715	2.2887	0.4577	3.8654	0.4611
51700	19.7479	2.5046	17.2433	1.3473	2.2972	0.4594	3.8840	0.4628
51700	20.9292	2.5150	18.4164	1.5231	2.3056	0.4611	3.9025	0.4645

AVER	AVG.ATT	MISS.P	REC.BK	CAP.T	HOLD.T	COMP.T
52600	1.0095	0.0089	0.0140	4.9381	33.6528	38.6104
52600	1.0100	0.0093	0.0154	4.9647	33.7007	38.6654
52600	1.0106	0.0098	0.0167	4.9913	33.7486	38.7204
52500	1.0117	0.0112	0.0244	5.0529	33.6404	38.7135
52500	1.0125	0.0119	0.0263	5.0862	33.6983	38.7845
52500	1.0133	0.0126	0.0282	5.1195	33.7563	38.8555

52400	1.0165	0.0164	0.0427	5.2614	33.7864	39.0693
52400	1.0179	0.0174	0.0454	5.3089	33.8419	39.1508
52400	1.0192	0.0184	0.0480	5.3565	33.8974	39.2322
52300	1.0247	0.0234	0.0698	5.6048	33.8290	39.4632
52300	1.0271	0.0251	0.0736	5.6818	33.8869	39.5686
52300	1.0294	0.0267	0.0773	5.7588	33.9447	39.6741
52200	1.0446	0.0390	0.1173	6.3627	34.0302	40.4170
52200	1.0491	0.0418	0.1225	6.4964	34.0844	40.5808
52200	1.0537	0.0447	0.1278	6.6300	34.1386	40.7446
52100	1.0819	0.0644	0.1862	7.6084	34.2059	41.8484
52100	1.0896	0.0687	0.1933	7.8266	34.2721	42.0986
52100	1.0973	0.0730	0.2003	8.0447	34.3383	42.3489
52000	1.1832	0.1210	0.3024	10.6665	34.4713	45.1585
52000	1.2060	0.1304	0.3155	11.2737	34.5401	45.8138
52000	1.2288	0.1399	0.3286	11.8808	34.6089	46.4691
51900	1.4900	0.2447	0.4906	18.9822	34.8727	53.8796
51900	1.5442	0.2609	0.5074	20.3565	34.9467	55.3032
51900	1.5984	0.2772	0.5242	21.7307	35.0206	56.7267
51800	2.4270	0.4586	0.7389	42.7601	35.2120	78.0130
51800	2.5831	0.4816	0.7565	46.5814	35.2904	81.8718
51800	2.7392	0.5046	0.7742	50.4026	35.3689	85.7306
51700	5.8750	0.7552	0.9240	126.5034	35.9344	162.4724
51700	6.2391	0.7704	0.9323	135.2836	36.0625	171.3461
51700	6.6031	0.7857	0.9406	144.0638	36.1904	180.2197

AVER	C.P.U	TIME	ARRMES	REAL.AR	REAL.RE	CAP.P.P	HOL.P	REP
52600	14.1	4972.26	2500.00	2479.66	2497.05	148.06		
52600	14.2	4993.02	2500.00	2480.63	2497.38	151.25	50.00100	
52600	14.3	5013.78	2500.00	2481.60	2497.71	154.43		
52500	14.0	4972.26	2500.00	2479.62	2497.11	131.68		
52500	14.0	4993.02	2500.00	2480.53	2497.42	135.18	50.00100	
52500	14.1	5013.78	2500.00	2481.43	2497.73	138.68		
52400	14.1	4972.26	2500.00	2479.74	2497.01	109.01		
52400	14.1	4993.02	2500.00	2480.66	2497.35	111.98	50.00100	
52400	14.2	5013.78	2500.00	2481.58	2497.69	114.94		
52300	14.0	4972.26	2500.00	2479.34	2496.66	91.04		
52300	14.1	4993.02	2500.00	2480.33	2497.04	93.84	50.00100	
52300	14.2	5013.78	2500.00	2481.32	2497.42	96.63		
52200	14.6	4972.26	2500.00	2478.73	2495.89	70.46		
52200	14.8	4993.02	2500.00	2479.84	2496.43	72.56	50.00100	
52200	14.9	5013.78	2500.00	2480.95	2496.97	74.66		

52100	21.9	4972.26	2500.00	2477.92	2495.32	54.70	
52100	22.2	4993.02	2500.00	2479.15	2496.09	56.27	50.00100
52100	22.4	5013.78	2500.00	2480.37	2496.86	57.84	
52000	24.6	4972.26	2500.00	2475.69	2493.14	39.78	
52000	25.2	4993.02	2500.00	2477.24	2494.34	41.12	50.00100
52000	25.9	5013.78	2500.00	2478.79	2495.54	42.46	
51900	22.8	4972.26	2500.00	2465.45	2483.31	27.77	
51900	24.2	4993.02	2500.00	2468.54	2486.19	28.63	50.00100
51900	25.6	5013.78	2500.00	2471.63	2489.07	29.50	
51800	47.9	4964.58	2500.00	2425.98	2443.81	20.11	
51800	54.7	4984.07	2500.00	2432.97	2450.75	20.68	50.00100
51800	61.5	5003.55	2500.00	2439.96	2457.69	21.26	
51700	249.8	4972.26	2500.00	2279.21	2296.18	15.63	
51700	282.5	4993.02	2500.00	2294.33	2311.29	15.82	50.00100
51700	315.1	5013.78	2500.00	2309.45	2326.40	16.01	

6. INFLUENCE OF MESSAGE SIZE ON SYSTEM PERFORMANCE (FIXED BUFFER SIZE OF 198 PACKETS)

LN	M.N	P.N	B.C	M.M	P.M	DEL
22300	3000	2	198	2.00	24.00	24.00	500
32300	3000	3	198	2.00	24.00	24.00	500
42300	3000	4	198	2.00	24.00	24.00	500
52300	3000	5	198	2.00	24.00	24.00	500
62300	3000	6	198	2.00	24.00	24.00	500
72300	3000	7	198	2.00	24.00	24.00	500
82300	3000	8	198	2.00	24.00	24.00	500
92300	3000	9	198	2.00	24.00	24.00	500

AVER	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
22300				0.0032				
22300				0.0034				
22300				0.0036				
22300	1.4194	0.9977	0.4212	0.0032	0.9924	0.4962	1.4160	0.4977
22300	1.4254	1.0018	0.4235	0.0034	0.9965	0.4982	1.4219	0.4998
22300	1.4313	1.0060	0.4258	0.0036	1.0005	0.5003	1.4277	0.5018
32300				0.0072				
32300				0.0076				
32300				0.0080				
32300	2.1367	1.4995	0.6367	0.0072	1.4896	0.4965	2.1291	0.4991
32300	2.1453	1.5054	0.6399	0.0076	1.4954	0.4985	2.1376	0.5011
32300	2.1539	1.5113	0.6431	0.0080	1.5012	0.5004	2.1461	0.5030
42300				0.0138				
42300				0.0143				
42300				0.0148				
42300	2.8457	1.9950	0.8500	0.0138	1.9801	0.4950	2.8313	0.4982
42300	2.8568	2.0028	0.8540	0.0143	1.9878	0.4969	2.8423	0.5001
42300	2.8678	2.0106	0.8579	0.0148	1.9955	0.4989	2.8533	0.5021
52300				0.0212				
52300				0.0218				
52300				0.0224				
52300	4.0585	2.4942	1.5639	0.0212	2.4752	0.4950	3.5380	0.4983
52300	4.0734	2.5046	1.5708	0.0218	2.4854	0.4971	3.5526	0.5004
52300	4.0922	2.5150	1.5776	0.0224	2.4956	0.4991	3.5671	0.5025

62300				0.0311				
62300				0.0320				
62300				0.0328				
62300	4.7773	2.9931	1.7839	0.0305	2.9693	0.4949	4.2465	0.4984
62300	4.7978	3.0055	1.7922	0.0313	2.9815	0.4969	4.2645	0.5005
62300	4.8183	3.0180	1.8006	0.0321	2.9937	0.4989	4.2824	0.5025
72300				0.0692				
72300				0.0725				
72300				0.0759				
72300	5.5322	3.4919	2.0395	0.0431	3.4624	0.4946	4.9623	0.4985
72300	5.5563	3.5064	2.0498	0.0440	3.4765	0.4966	4.9827	0.5005
72300	5.5803	3.5210	2.0602	0.0449	3.4907	0.4987	5.0031	0.5026
82300				0.7481				
82300				0.8329				
82300				0.9177				
82300	7.3305	3.9907	3.3324	0.0842	3.9502	0.4938	5.8338	0.4979
82300	7.4481	4.0074	3.4408	0.0904	3.9660	0.4957	5.8667	0.4999
82300	7.5658	4.0240	3.5491	0.0966	3.9818	0.4977	5.8996	0.5019
92300				12.3576				
92300				13.9168				
92300				15.4760				
92300	20.6860	4.4896	16.1921	1.7002	4.1883	0.4654	6.8081	0.4698
92300	22.2639	4.5083	17.7556	2.0788	4.2088	0.4676	6.8567	0.4720
92300	23.8419	4.5270	19.3192	2.4575	4.2292	0.4699	6.9054	0.4743

AVER	AVG.ATT	MISS.P	REC.BK	CAP.T	HOLD.T	COMP.T
22300	1.1373	0.0022	0.0000	11.1726	16.3711	27.5720
22300	1.1386	0.0024	0.0000	11.2057	16.4307	27.6363
22300	1.1399	0.0026	0.0000	11.2387	16.4902	27.7007
32300	1.0496	0.0034	0.0000	7.7814	24.7005	32.5072
32300	1.0504	0.0036	0.0000	7.8091	24.7499	32.5590
32300	1.0512	0.0037	0.0000	7.8367	24.7994	32.6108
42300	1.0181	0.0048	0.0000	5.9616	29.9111	35.8919
42300	1.0187	0.0050	0.0000	5.9829	29.9715	35.9544
42300	1.0192	0.0052	0.0000	6.0042	30.0320	36.0169
52300	1.0069	0.0059	0.0000	4.7967	33.5820	38.3972
52300	1.0072	0.0061	0.0000	4.8147	33.6360	38.4507
52300	1.0075	0.0063	0.0000	4.8328	33.6900	38.5042
62300	1.0026	0.0073	0.0007	4.0337	36.4556	40.5040
62300	1.0028	0.0074	0.0010	4.0487	36.5109	40.5596
62300	1.0029	0.0076	0.0012	4.0636	36.5662	40.6151
72300	1.0039	0.0137	0.0000	3.6933	38.8414	42.5548
72300	1.0045	0.0143	0.0000	3.7249	38.8913	42.6162
72300	1.0051	0.0150	0.0000	3.7565	38.9413	42.6777
82300	1.1328	0.1111	0.0000	8.1498	41.6641	49.8420

82300	1.1528	0.1205	0.0000	8.7090	41.7354	50.4445
82300	1.1728	0.1298	0.0000	9.2683	41.8068	51.0470
92300	3.2321	0.5991	0.8334	62.0219	45.2951	107.3483
92300	3.4732	0.6248	0.8496	67.8963	45.5294	113.4257
92300	3.7143	0.6505	0.8657	73.7707	45.7637	119.5031

AVER	C.P.U	TIME	ARRMES	REAL.AR	REAL.RE	CAP.P.P	HOL.P REP
22300	4.9	4972.26	2500.00	2485.88	2493.71	441.26	
22300	4.9	4993.02	2500.00	2486.59	2494.20	461.52	24.00100
22300	4.9	5013.78	2500.00	2487.30	2494.69	481.78	
32300	7.6	4964.58	2500.00	2482.57	2495.99	291.02	
32300	7.6	4984.07	2500.00	2483.42	2496.36	299.39	36.00100
32300	7.7	5003.55	2500.00	2484.27	2496.73	307.76	
42300	10.5	4975.38	2500.00	2480.48	2496.80	211.27	
42300	10.5	4994.96	2500.00	2481.27	2497.18	215.00	44.00100
42300	10.6	5014.54	2500.00	2482.06	2497.56	218.73	
52300	12.9	4972.26	2500.00	2479.90	2497.14	182.76	
52300	12.9	4993.02	2500.00	2480.85	2497.46	185.37	50.00100
52300	13.0	5013.78	2500.00	2481.80	2497.78	187.97	
62300	23.8	4972.26	2500.00	2479.16	2497.50	149.49	
62300	23.9	4993.02	2500.00	2480.04	2497.80	151.34	54.80100
62300	24.0	5013.78	2500.00	2480.92	2498.10	153.19	
72300	29.0	4972.26	2500.00	2477.74	2497.82	99.24	
72300	29.2	4993.02	2500.00	2478.69	2498.06	101.22	58.80100
72300	29.3	5013.78	2500.00	2479.64	2498.30	103.21	
82300	28.2	4972.26	2500.00	2472.59	2493.79	32.76	
82300	28.9	4993.02	2500.00	2474.23	2494.93	33.97	62.23100
82300	29.6	5013.78	2500.00	2475.87	2496.07	35.19	
92300	186.1	4972.26	2500.00	2318.51	2340.47	13.09	
92300	216.4	4993.02	2500.00	2335.27	2357.21	13.47	65.23100
92300	246.6	5013.78	2500.00	2352.03	2373.95	13.85	

7. INFLUENCE OF MESSAGE SIZE ON SYSTEM PERFORMANCE (FIXED BUFFER SIZE OF 22 MESSAGES)

LN	M.N	P.N	B.C	M.M	P.M	DEL	
22200	3000	2	44	2.00	24.00	24.00	500
32200	3000	3	66	2.00	24.00	24.00	500
42200	3000	4	88	2.00	24.00	24.00	500
52200	3000	5	110	2.00	24.00	24.00	500
62200	3000	6	132	2.00	24.00	24.00	500
72200	3000	7	154	2.00	24.00	24.00	500
82200	3000	8	176	2.00	24.00	24.00	500
92200	3000	9	198	2.00	24.00	24.00	500

AVER	T.TRAN	N.TRAN	RE.TRAN	ATTRITI	P.REC	M.REC	OUT.SY	RES
22200				0.0032				
22200				0.0034				
22200				0.0037				
22200	1.4194	0.9977	0.4212	0.0032	0.9924	0.4962	1.4160	0.4977
22200	1.4254	1.0018	0.4235	0.0034	0.9965	0.4982	1.4219	0.4998
22200	1.4313	1.0060	0.4258	0.0037	1.0005	0.5003	1.4277	0.5018
32200				0.0113				
32200				0.0120				
32200				0.0128				
32200	2.1420	1.4995	0.6420	0.0076	1.4895	0.4965	2.1304	0.4992
32200	2.1509	1.5054	0.6455	0.0079	1.4953	0.4984	2.1389	0.5011
32200	2.1597	1.5113	0.6490	0.0083	1.5011	0.5004	2.1474	0.5031
42200				0.0399				
42200				0.0422				
42200				0.0445				
42200	2.8808	1.9950	0.8850	0.0141	1.9798	0.4950	2.8395	0.4981
42200	2.8932	2.0028	0.8904	0.0146	1.9875	0.4969	2.8506	0.5000
42200	2.9056	2.0106	0.8959	0.0151	1.9952	0.4988	2.8618	0.5020
52200				0.1465				
52200				0.1587				
52200				0.1710				
52200	4.2310	2.4942	1.7347	0.0241	2.4744	0.4949	3.5819	0.4982
52200	4.2580	2.5046	1.7534	0.0251	2.4844	0.4969	3.5979	0.5002
52200	4.2850	2.5150	1.7721	0.0260	2.4944	0.4989	3.6140	0.5023

62200				0.4362				
62200				0.4768				
62200				0.5174				
62200	5.2979	2.9931	2.3008	0.0421	2.9659	0.4943	4.3563	0.4980
62200	5.3577	3.0055	2.3522	0.0445	2.9779	0.4963	4.3788	0.5000
62200	5.4176	3.0180	2.4036	0.0469	2.9898	0.4983	4.4014	0.5020
72200				1.3096				
72200				1.4581				
72200				1.6066				
72200	7.1735	3.4919	3.6765	0.0913	3.4496	0.4928	5.2105	0.4968
72200	7.3559	3.5064	3.8494	0.1021	3.4632	0.4947	5.2451	0.4988
72200	7.5383	3.5210	4.0224	0.1130	3.4768	0.4967	5.2798	0.5007
82200				3.9211				
82200				4.4272				
82200				4.9333				
82200	11.1089	3.9987	7.1061	0.2964	3.8944	0.4868	6.1034	0.4912
82200	11.6553	4.0144	7.6410	0.3560	3.9073	0.4884	6.1457	0.4928
82200	12.2018	4.0300	8.1759	0.4157	3.9201	0.4900	6.1881	0.4944
92200				12.3576				
92200				13.9168				
92200				15.4760				
92200	20.6860	4.4896	16.1921	1.7002	4.1883	0.4654	6.8081	0.4698
92200	22.2639	4.5083	17.7556	2.0788	4.2088	0.4676	6.8567	0.4720
92200	23.8419	4.5270	19.3192	2.4575	4.2292	0.4699	6.9054	0.4743

AVER	AVG.ATT	MISS.P	REC.BK	CAP.T	HOLD.T	COMP.T
22200	1.1373	0.0022	0.0000	11.1720	16.3736	27.5743
22200	1.1386	0.0024	0.0000	11.2056	16.4328	27.6384
22200	1.1399	0.0026	0.0000	11.2393	16.4919	27.7025
32200	1.0528	0.0052	0.0053	7.8762	24.6812	32.5844
32200	1.0538	0.0056	0.0059	7.9086	24.7330	32.6415
32200	1.0548	0.0059	0.0066	7.9409	24.7847	32.6985
42200	1.0287	0.0138	0.0348	6.3756	29.9980	36.3963
42200	1.0297	0.0145	0.0367	6.4152	30.0541	36.4693
42200	1.0308	0.0153	0.0387	6.4548	30.1102	36.5422
52200	1.0446	0.0390	0.1173	6.3627	34.0302	40.4170
52200	1.0491	0.0418	0.1225	6.4964	34.0844	40.5808
52200	1.0537	0.0447	0.1278	6.6300	34.1386	40.7446
62200	1.1101	0.0896	0.2525	8.0677	37.2215	45.3157
62200	1.1232	0.0962	0.2628	8.4361	37.2830	45.7191
62200	1.1364	0.1029	0.2731	8.8045	37.3445	46.1225
72200	1.3168	0.1928	0.4486	13.8380	40.0400	53.8985
72200	1.3577	0.2076	0.4670	14.9177	40.1167	55.0344
72200	1.3986	0.2225	0.4854	15.9974	40.1934	56.1702
82200	1.8643	0.3633	0.6621	28.1070	42.4661	70.6021

82200	1.9766	0.3879	0.6821	30.9090	42.5643	73.4733
82200	2.0889	0.4124	0.7020	33.7110	42.6625	76.3446
92200	3.2321	0.5991	0.8334	62.0219	45.2951	107.3483
92200	3.4732	0.6248	0.8496	67.8963	45.5294	113.4257
92200	3.7143	0.6505	0.8657	73.7707	45.7637	119.5031

AVER	C.P.U	TIME	ARRMES	REAL.AR	REAL.RE	CAP.P.P	HOL.P REP
22200	5.1	4972.26	2500.00	2485.88	2493.71	440.21	
22200	5.1	4993.02	2500.00	2486.59	2494.20	460.33	24.00100
22200	5.2	5013.78	2500.00	2487.30	2494.69	480.45	
32200	7.9	4964.58	2500.00	2482.37	2496.27	233.20	
32200	8.0	4984.07	2500.00	2483.23	2496.65	239.90	36.00100
32200	8.0	5003.55	2500.00	2484.09	2497.03	246.60	
42200	11.0	4975.38	2500.00	2480.09	2496.30	124.59	
42200	11.0	4994.96	2500.00	2480.94	2496.74	127.70	44.00100
42200	11.1	5014.54	2500.00	2481.79	2497.18	130.81	
52200	14.6	4972.26	2500.00	2478.73	2495.89	70.46	
52200	14.8	4993.02	2500.00	2479.84	2496.43	72.56	50.00100
52200	14.9	5013.78	2500.00	2480.95	2496.97	74.66	
62200	28.4	4972.26	2500.00	2475.58	2494.39	41.90	
62200	28.8	4993.02	2500.00	2477.05	2495.37	43.27	54.80100
62200	29.3	5013.78	2500.00	2478.52	2496.35	44.64	
72200	30.0	4972.26	2500.00	2466.66	2487.11	26.45	
72200	31.4	4993.02	2500.00	2469.27	2489.42	27.43	58.80100
72200	32.8	5013.78	2500.00	2471.88	2491.73	28.42	
82200	58.3	4964.58	2500.00	2426.86	2448.72	18.09	
82200	64.7	4984.07	2500.00	2433.70	2455.52	18.77	62.23100
82200	71.1	5003.55	2500.00	2440.54	2462.32	19.46	
92200	186.1	4972.26	2500.00	2318.51	2340.47	13.09	
92200	216.4	4993.02	2500.00	2335.27	2357.21	13.47	65.23100
92200	246.6	5013.78	2500.00	2352.03	2373.95	13.85	

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7.	Col Yen-Chun Feng 7, Lane 72, Tzu-Lin, Chin-Tan, 23180 Sin-Tien County, Taipei, Taiwan, R.O.C.	1
8.	LCDR Kuo-Tung Shih 4FL 1, No.31, Lane 2023, Chiu Ju 4th Road Kaohsiung, Taiwan, R.O.C.	3